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Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments

Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems

Report of the Secretary-General

Summary

The present report is prepared in response to General Assembly resolution 60/31, paragraphs 73 and 74, in which the Assembly requested information regarding actions taken to give effect to paragraphs 66 to 69 of resolution 59/25, to address the impacts of fishing on vulnerable marine ecosystems.

The report describes some of the most vulnerable marine ecosystems; some fishing practices that, in specific circumstances, may be harmful; and the types of damage that may be caused, either directly or indirectly, by certain fishing practices. It should be read in conjunction with earlier reports on related issues, in particular reports of the Secretary-General on oceans and the law of the sea (A/58/65, A/59/62 and A/60/63/Add.1), as well as recent fisheries reports (A/60/189 and A/CONF.210/2006/1). Pursuant to the above-mentioned resolutions, the report outlines actions taken by States either by themselves or through regional fisheries

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management organizations and arrangements (RFMOs) to address destructive fishing practices that may have adverse impacts on vulnerable marine ecosystems, as well as such actions taken by RFMOs. The report also describes actions taken by some RFMOs to expand their competence, and recent initiatives by States to establish new RFMOs where none exist.

Contents

		Paragraphs	Page
	Abbreviations		4
I.	Introduction	1–4	5
II.	Vulnerable marine ecosystems and destructive fishing practices	5–56	6
	A. Vulnerable marine ecosystems	7–17	6
	B. Fishing practices which may have destructive impacts	18–23	9
	C. Impacts of fishing practices, including bottom-trawling, on vulnerable marine ecosystems	24–56	10
III.	Actions by States to address fishing practices that may have an adverse impact on vulnerable marine ecosystems	57–129	17
	A. Introduction	57–59	17
	B. Actions by States in areas under national jurisdiction	60–99	18
	C. Actions by States in areas beyond national jurisdiction	100–117	24
	D. Data collection and research	118–129	27
IV.	Actions by regional fisheries management organizations and arrangements with the relevant competence to address the impact of destructive fishing practices	130–180	29
	A. Measures to address the impact of destructive fishing practices	132–173	30
	B. Measures to ensure compliance	174–180	35
V.	Expansion of the competence of regional fisheries management organizations and arrangements	181–186	36
VI.	Establishment of new regional fisheries management organizations and arrangements	187–200	37
	A. South Indian Ocean	187–192	37
	B. Pacific Ocean	193–200	38
VII.	Conclusions	201–209	39

Abbreviations

CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
EC	European Community
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
FIGIS	Fisheries Global Information System
FIRMS	Fishery Resources Monitoring System
GEF	Global Environment Facility
GFCM	General Fisheries Commission for the Mediterranean
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
IOTC	Indian Ocean Tuna Commission
IPHC	International Pacific Halibut Commission
IUU fishing	Illegal, unreported and unregulated fishing
NAFO	Northwest Atlantic Fisheries Organization
NASCO	North Atlantic Salmon Conservation Organization
NEAFC	North East Atlantic Fisheries Commission
OLDEPESCA	Organizacion Latinoamericana de Desarrollo Pesquero
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
RFMO	Regional fisheries management organization
SEAFO	South East Atlantic Fisheries Organization
SIOFA	South Indian Ocean Fisheries Agreement
SWIOFC	South West Indian Ocean Fisheries Commission
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission

I. Introduction

1. At its fifty-ninth session, the General Assembly adopted resolution 59/25, paragraphs 66 to 71 of which relate to the preparation of the present report and read as follows:

> 66. *Calls upon* States, either by themselves or through regional fisheries management organizations or arrangements, where these are competent to do so, to take action urgently, and consider on a case-by-case basis and on a scientific basis, including the application of the precautionary approach, the interim prohibition of destructive fishing practices, including bottom-trawling that has adverse impacts on vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals located beyond national jurisdiction, until such time as appropriate conservation and management measures have been adopted in accordance with international law;
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> 67. *Calls upon* regional fisheries management organizations or arrangements with the competence to regulate bottom-fisheries urgently to adopt, in their regulatory areas, appropriate conservation and management measures, in accordance with international law, to address the impact of destructive fishing practices, including bottom-trawling that has adverse impacts on vulnerable marine ecosystems, and to ensure compliance with such measures;
>
> 68. *Calls upon* members of regional fisheries management organizations or arrangements without the competence to regulate bottom-fisheries and the impacts of fishing on vulnerable marine ecosystems to expand the competence, where appropriate, of their organizations or arrangements in this regard;
>
> 69. *Calls upon* States urgently to cooperate in the establishment of new regional fisheries management organizations or arrangements, where necessary and appropriate, with the competence to regulate bottom-fisheries and the impacts of fishing on vulnerable marine ecosystems in areas where no such relevant organization or arrangement exists;
>
> 70. *Requests* the Secretary-General, in cooperation with the Food and Agriculture Organization of the United Nations, to include in his next report concerning fisheries a section on the actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 above, in order to facilitate discussion of the matters covered in those paragraphs;
>
> 71. *Agrees* to review within two years progress on action taken in response to the requests made in paragraphs 66 to 69 above, with a view to further making recommendations, where necessary, in areas where arrangements are inadequate.

2. The request in paragraph 70 was complied with (A/60/189, paras. 116-135). Further, by paragraph 73 of its resolution 60/31, the General Assembly requested the Secretary-General, in cooperation with the Food and Agriculture Organization of the United Nations (FAO), to report to it at its sixty-first session on the actions taken by States and regional fisheries management organizations and arrangements (RFMOs)

to give effect to the relevant provisions of resolution 59/25, in order to facilitate the review of progress on those actions, so that further recommendations could be made, where necessary, in areas where arrangements were inadequate.

3. Pursuant to the provisions of the above resolutions, Member States, FAO and RFMOs were requested to provide the necessary information. In response to that request, submissions were received from 25 States, the European Community, 12 RFMOs and FAO. In addition, information was received from some NGOs and members of the scientific community.

4. The present report has been prepared in response to the aforementioned resolutions and is based on the information provided by States and RFMOs, and other pertinent information.

II. Vulnerable marine ecosystems and destructive fishing practices

5. In the context of General Assembly resolutions 59/25 and 60/31, the present section describes potentially destructive fishing practices, those marine ecosystems or features that may be most vulnerable to such practices, and their likely impacts.

6. The FAO Code of Conduct for Responsible Fisheries and the subsequent Technical Guidelines[3] provide a useful framework for considering the impacts of potentially destructive fishing practices on vulnerable marine ecosystems. The following key elements of the FAO Technical Guidelines for Responsible Fisheries are most relevant:

(a) Prevention of overfishing by controlling overall fishing pressure through input or output controls;

(b) Minimization of catch of non-target species through by-catch limits and gear modifications and restrictions;

(c) Prevention of habitat degradation through protected areas, gear modifications and restrictions;

(d) Collection and analysis of comprehensive data on fisheries and ecosystem properties to increase scientific knowledge and monitor fishery impacts;

(e) Advancement of scientific research on marine ecosystems and their response to fishery impacts;

(f) Enforcement of management actions to protect vulnerable ecosystems;

(g) Implementation of interim measures for ecosystem protection; and

(h) Application of the precautionary approach for marine fisheries.

A. Vulnerable marine ecosystems

7. Earlier reports of the Secretary-General have provided descriptions of a number of vulnerable marine ecosystems, especially those in the deep sea beyond the limits of national jurisdiction (see A/58/65, A/59/62 and A/60/63/Add.1). The related concept of sensitive habitats has recently been defined as those habitats that

are easily adversely affected by a human activity, and/or those where an affected area is expected to recover only over a very long period, or not at all.[2]

8. The OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic has identified a number of sensitive habitats as follows: (a) sea pens and burrowing megafauna communities, which consist of plains of fine mud, at water depths ranging from 15 to 200 m or more; (b) reefs (recorded in depths from 10 to 50 m or more), such as those that contain tube-building polychaetes (*Sabellaria spinulosa*), which can form dense communities on mixed substrata and on rocky habitats; (c) oyster (*Ostrea edulis*) beds on shallow, mostly sheltered sediments (typically up to 10 m depth, but occasionally down to 30 m), which consist of clumps of dead shells and oysters that can support large numbers of ascidians, large taxa including polychaetes, suspension-feeding polychaetes and a turf of seaweeds.[3]

9. Sensitive habitats also lie within deep-sea areas, which support a wide variety of species and populations, and in which research over the past decade has revealed remarkably high levels of biodiversity and endemism associated with many deep-sea ecosystems.[2,4]

10. Today, it is estimated that approximately 98 per cent of known marine species live in benthic environments and that more species live in benthic environments than in all the other environments on earth combined. Most of these species are still unknown (A/59/62/Add.1, para. 46). The previously unsuspected high diversity of the deep-sea floor was first discovered in the late 1960s, yet only a small fraction of the many ecosystems found on the ocean bottom at depths below 200 m has been studied. For example, some 921 species have been recorded from seamounts.[5] For some deep-water species of fish, there is evidence for genetic differentiation among populations on the transoceanic, oceanic and regional levels, suggesting that historic long-distance dispersal has largely determined present day distribution.[6]

11. It has been reported that around 15 per cent of the 597 species, mainly megafauna, which occur on seamounts globally were considered to be endemic.[7] Some studies on Australian seamounts indicated much higher levels.[8] Of the macro and megafauna found, an estimated 16 to 36 per cent were new to science (A/59/62/Add.1, para. 176). Low species overlap was found between seamounts in different portions of the region suggesting that these seamounts function as islands or chains with important consequences for speciation.[9] On 14 seamounts off southern Tasmania, 24 to 43 of the species sampled were new to science and 16 to 33 per cent were endemic.[8]

12. Other benthic habitats such as deep-water corals have high habitat diversity as evidenced by studies of *Lophelia pertusa* where more than 800 species were recorded as living on or around these corals in the north-east Atlantic.[10] The fauna associated with sponge fields is estimated to be as least twice as rich in species as the surrounding gravel or soft bottoms, and many species are much more abundant within the fields than beyond.[11] Other studies have documented that the diversity, quality and extent of bottom-habitats are vital determinants of the diversity, distribution and abundance of rockfish and other species.[12] Additionally, species richness and community composition over smaller scales also correlate with three-dimensional structure.[13]

13. A growing body of scientific literature indicates that even these seemingly remote areas are now being impacted by fishing activities. The vulnerable deep-sea habitats likely to be most impacted by fishing are seamounts and deep-water reefs. Some others, about which less is known concerning fishing impacts, include cold seeps and pock marks, hydrothermal vents, sponge fields, oceanic slopes, polymetallic nodules, trenches and canyons.[2,4,6,14] Some additional information about sponge fields, oceanic slopes, polymetallic nodules and carbonate mounds is contained below. For information about most of these ecosystems, see previous reports of the Secretary-General (A/58/65, A/59/62 and A/60/63/Add.1) and the relevant scientific literature.

1. Sponge fields

14. Sponge fields are a characteristic benthic component of many deep-sea assemblages all over the world, the majority of samples having been taken between 800 and 6,000 m depth. Some 65 species have been described to date.[15] Due to their large size, slow growth rates and weak cementation, most sponge species are very fragile and thus only sampled via photographic methods. Despite this fragility, specimens may be quite abundant on abyssal seabeds.[16] Mass occurrences of large sponges occur around the Faroe Islands, East Greenland, around Iceland, in the Skageraak off Norway and in the Barents Sea.[17] The presence of the large sponges adds a low three-dimensional structure to the bottom, thus increasing habitat complexity and attracting a large number of other, smaller species from many phylae. These associated fauna have been investigated in the Faroe Islands, where it was found that the sponges house about 250 species of invertebrates.[18] It is believed that sponge fields may provide an important feeding habitat for various fish species including young ocean perch (*Sebastes* spp.) and groundfish. The fauna associated with sponge fields is reported to be at least twice as rich in species as the surrounding gravel or soft bottoms.[19]

2. Oceanic slopes

15. The slopes of oceanic island groups form a unique habitat. The lower parts of these slopes may be equated with seamount communities, but their upper slope habitats do not occur elsewhere.[20] There is growing evidence that demersal or benthopelagic deep-water fish and squid species tend to show limited dispersal between island groups such that depleted populations may not be replenished from other areas.[21]

3. Polymetallic nodules

16. Polymetallic nodules form flat horizontal fields at depths from 4,000 and 6,000 m, such as in the Pacific central abyssal basin. In the Indian Ocean, they are most abundant south of the Equator, in basins to the east and west of the Ninety Degree Ridge. Other areas include the Central Indian Basin, the Crozet Basin, the Agulhas Plateau, the Wharton Basin, the Madagascar Basin, the South Australian Basin, and the Mozambique Ridge and Channel. These nodule fields are inhabited by diverse epifauna that provide habitats for other species.[22]

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4. Carbonate mounds

17. Carbonate mounds are very steep-sided mounds of a variety of shapes, which may be up to 350 m high and 2 km wide at their base.[23] They occur offshore in water depths of 500 to 1,100 m with examples present in the Porcupine Seabight and Rockall Trough.[24] Carbonate mounds are typically composed of carbonate sands, muds and silts. The cold-water reef-building corals (*Lophelia pertusa* and *Madrepora oculata*), as well as echiuran worms, are characteristic fauna of carbonate mounds.[3]

B. Fishing practices which may have destructive impacts

18. As near shore fisheries for groundfish (i.e., roundfish and flatfish) and crustaceans like shrimp, lobster and scallops have declined, and as technology developed to target more efficiently large and small pelagic species (e.g., with the purse seine and midwater trawl), fisheries have expanded further offshore into deeper waters.[4,25] Fisheries on slopes first and high-seas seamounts later on were facilitated by the development of deep-sea mapping and the improvement in positioning systems. Deep-sea fisheries are conducted in many parts of the world, including: (a) the south-west Pacific Oceans, where fisheries for orange roughy, black oreo, smooth oreo and blue grenadier exist; (b) the north Pacific Ocean, where a fishery for sablefish operates along the continental slope of North America and where a fishery for armourhead operated in the 1960s and 1970s but has been fished to commercial extinction; (c) the Atlantic and Pacific Oceans, where fisheries exist for *Sebastes* species, including Pacific ocean perch (*Sebastes alutus*); (d) the north-east Atlantic Ocean, where fisheries for deep-sea species such as *Argentina silus*, ling (*Molva molva*), blue ling, tusk, orange roughy, greater forkbeard, roundnose grenadier, black scabbardfish and deep-sea sharks exist; (e) the southern Atlantic Ocean, where there is a fishery for orange roughy; (f) the south-west Indian Ocean, where high-seas fisheries for orange roughy and alfonsino operate on the Madagascar ridge; and (g) the Southern Ocean, where several countries fish for deep-sea species, particularly Patagonian toothfish.[4,25]

19. Fishermen now have access to fishing grounds over deep-sea habitats, where new technology allows a high yield per unit effort, potentially depleting target stocks and associated species.[4,25] Fishing operations are typically conducted on or around deep-sea fish habitats, such as seamounts, cold-water reefs, ridges and trenches. Fishing vessels are now operating at depths greater than 400 m, sometimes as great as 1,500 to 2,000 m (A/60/189, para. 116).

1. Bottom-trawling and dredging

20. Bottom-trawls are mobile fishing gear towed behind a vessel. There are two basic types of bottom-trawls: beam trawls (including rigid gear such as scallop dredges) and otter trawls. A cone shaped, bag-like net is held open either by a solid beam or frame or by doors (known as otter boards) made of steel or wood.[26] Large trawl doors weighing as much as six tons are in contact with the seafloor during the tow and keep the net open by the force of the water pressure. To secure contact between the seabed and the net, the groundline can be weighted by chains or cables with heavy discs or rollers.[27] This enables the trawl to fish over rough seabeds of rocks, boulders or corals. The nets can be as large as 55 m across and 12 m high.

The mesh size of the net is appropriate to target species, smaller mesh is used to catch shrimp and larger mesh is used to catch gadoids, flatfish, rockfish or other bottom-dwelling species. Pair-trawling is undertaken by two vessels towing a single net. The advantage of pair bottom-trawling is that considerably more ground gear can be used so as to increase the area swept.[25] Bottom-trawling substantially increased in the 1980s with the advent of more robust rock-hopper or roller gear which allowed larger vessels to fish rougher and previously inaccessible areas.[26] Dredging gear consists of a frame made of steel with a mounted net towed behind the vessel. Large dredges weighing one ton are used to catch clams, scallops and oysters.[27]

2. Bottom-set longlines

21. The bottom-set longline, also known as demersal longlining, is static gear consisting of a thick synthetic or steel line to which shorter lines or baited hooks (up to 12,000 per line) are mounted. Weights are used to sink the gear to the seabed. This gear is used to catch a variety of fish including redfish, tusk, ling, sablefish, groupers, cod, haddock and dogfish.[26,27] This type of gear is used around *Lophelia* coral reefs off Norway[14,28] and in gorgonian coral forests off Alaska. It also has been used along seamounts near the Azores to catch red (blackspot) seabream (*Pagellus bogaraveo*), wreckfish (*Polyprion americanus*), conger eel (*Conger conger*), bluemouth (*Helicolenus dactylopterus*), Kuhl's scorpionfish (*Scorpaena scrofa*), greater forkbeard (*Phycis blennoides*), alfonsinos (*Beryx* spp.), and common mora (*Mora moro*).[29] Longliners also fish for giant redfish (*Sebastes mentella*) on the Reykjanes Ridge.[7]

3. Bottom-set gillnets

22. The bottom-set or sink-net gillnet is a curtain of mesh made out of a synthetic material like monofilament. It fishes along the seafloor using a system of weights and floats. The primary species caught are gadoids, flatfish, skates and rays. The nets can measure 100 m in length and roughly 3 m in width, and often 10 to 12 nets are tied together in a line.[26] Such gear is used throughout the Atlantic, Pacific and Indian Oceans.

4. Pots and traps

23. Pots and traps consist of frames made of wood, aluminium, steel or vinyl-covered wire, which are set out in lines connected by a rope. They are used to catch crab, lobster, prawn and whelk. Pot and trap fishing reportedly takes place in coral-covered carbonate mounds.[27]

C. Impacts of fishing practices, including bottom-trawling, on vulnerable marine ecosystems

1. Destructive practices

(a) Overfishing

24. By and large, the dominant human-caused direct effect on marine ecosystems is fishing.[30] While fisheries are vitally important to the global economy as a source of food, employment and support for coastal communities, the impact of overfishing

on the health and productivity of marine ecosystems has grown to be a concern for the international community. Even if target species are not being overfished, fishing affects marine habitats and has the potential to alter the functioning, state and biodiversity of marine ecosystems, particularly vulnerable ecosystems.

25. Scientific research has revealed numerous ecosystem-wide effects of fishing in marine ecosystems.[31] There is conclusive evidence that stock biomass and abundance have been reduced by fishing. A significant reduction of biomass is unavoidable and even necessary to obtain food and livelihood, but a large number of stocks have been reduced below sustainable levels.

26. There are ample data to suggest that fisheries exploitation affects not only target stocks and other fish species, but also communities of organisms, ecological processes and entire ecosystems by causing cascading effects down food webs that decrease diversity or productivity.[31] It also affects directly vulnerable habitats, such as reef ecosystems, when gears are in contact with the reef substratum, or indirectly by altering the relationships between those communities of plants, invertebrates and fish species that determine rates of reef accretion and bioerosion. For example, coral accretion relies upon the successful settlement of young corals, and the maintenance of suitable conditions for their growth.[32] Thus, environmental damage may result from the nature of some fishing technology or from the inappropriate use of an otherwise acceptable gear in a particular marine ecosystem. However, these impacts are not uniform. They are affected by the spatial and temporal distribution of fishing effort and vary with the fishing methodologies used and the habitat type and environment concerned.

27. There are both direct and indirect effects of fishing. The direct effects are: (a) mortality of target and non-target species as well as the killing of or injury to benthic species, making them vulnerable to scavengers or predators; (b) increased food availability of discarded fish, fish offal and dead benthic organisms for predators; and (c) loss of habitat as fishing gear causes destruction or disturbance of the seafloor.[28,33]

28. Indirect effects of fishing result in changes in marine ecosystems.[28,33] Scientists have summarized these indirect effects as follows: (a) fishing affects predator-prey relationships, which can lead to shifts in community structures that do not revert to the original condition upon the cessation of fishing pressure; (b) fishing can alter the population size and body size composition of species by affecting populations of large slow-growing and late-maturing species, leading to shifts in the relative abundance of species with different life history characteristics; (c) fishing can affect populations of non-target species (e.g. cetaceans, birds, reptiles and elasmobranch fish) as a result of by-catches; (d) fishing gear lost or voluntarily discarded at sea may apparently continue to catch fish for some time (ghost fishing) affecting both target and non-target stocks; (e) fishing can reduce habitat complexity and perturb seabed (benthic) communities; and (f) fishing can lead to genetic selection for different body and reproductive traits and can extirpate distinct local stocks.[28,33]

(b) Trawling and dredging

29. Among all the fishing gears currently used, particular concern has been raised over the adverse impacts of bottom-trawling on vulnerable marine ecosystems and their associated biodiversity. Bottom-trawling raises two main issues. One concern,

common to all fishing gear, is the sustainability of the exploitation of target fish stocks due to excess fishing effort or capacity. The second is the ecosystem impacts of trawl fisheries deriving from: (a) the inadequate selectivity of trawl nets and consequent impact on target species (through capture of juveniles) and non-target species whether discarded or not; and (b) their physical impact on the bottom, and its fauna and the resulting damage to vulnerable ecosystems as critical habitats for marine biodiversity.[28,33]

30. In near-shore areas, numerous studies have shown the effects of mobile bottom-fishing gear in particular on benthic habitats and communities.[28,34] Trawling and dredging reduce habitat complexity. Repeated trawling and dredging result in discernable changes in benthic communities and the productivity of benthic habitats. Fauna that live in low disturbance regimes are generally more vulnerable to disturbance by trawling. Fishing gear that disturbs the sediment surface can change sediment grain size distribution or characteristics. Suspended load and magnitude of sediment transport processes and direct alterations of habitat can cause species shift and general decline in abundance of some of the benthic organisms.[28]

31. It should be noted that there is little scientific and objective information on the impact beyond a first level (visual and short-term) on the overall productivity of deep-water systems and their resilience. However, a review undertaken by FAO in 2005 recognizes the lack and difficulty of rigorous scientific analysis, the lack of long-time series, baselines, or reference areas, the difficulty and lack of real-scale experimentation, and the need for more and better documented investigations on bottom impacts of trawling.[35]

32. While there is some evidence to suggest that bottom-set longlines, bottom-set gillnets, pots and traps, including when ghost fishing, all may be affecting the deep-sea, bottom-trawling and dredging appear to be having the most obvious disruptive impact due to their widespread use and their contact with the bottom.[2] Trawls and dredges remove organisms, rocks and sediments, reducing habitat complexity and, on soft substrate, stir up sediment that can smother bottom-dwelling communities. In addition, by-catch of non-target species can be high.[27] It is believed that about 95 per cent of the damage inflicted on deep-water systems associated with seamounts results from bottom-trawling (A/60/189, para. 122).

33. The detrimental effects of bottom-trawling and dredging in the following locations are well documented: *Oculina* coral reefs off eastern Florida;[27] reefs on the summits of some south Tasmanian seamounts;[36] the oceanic banks in New Zealand waters;[2] the octocoral gardens in Alaskan waters;[37] coral grounds off Nova Scotia;[38] *Lophelia* reefs in Scandinavian waters;[29] off western Ireland;[39] in the northern Rockall Trough, Darwin Mounds and Porcupine Seabight;[2,40] all along the north-east Atlantic shelf break area off Ireland, Scotland and Norway;[10,41] and in the north-east Channel, and at Stone Fence at the mouth of the Laurentian Channel,[27] off New England.[42] It also is known that trawl fisheries operated outside the Azores economic exclusion zone (EEZ) for alfonsinos, orange roughy (*Hoplostethus atlanticus*), deepwater cardinal fish (*Epigonus telescopus*), black scabbardfish (*Aphanopus carbo*), several deep-water shark species, and wreckfish (*Polyprion americanus*) and along the northern end of the Mid-Atlantic Ridge and the Reykjanes Ridge for roundnose grenadier (*Coryphaenoides rupestris*) and alfonsinos. The actual impact of these fisheries on sensitive deep-sea habitats and

the species that occupy them is unknown, but it is known that at least in the latter two fisheries there was an incidental catch of orange roughy.[43]

34. It has been suggested that, in parts of the European continental slope, the distribution of *Lophelia pertusa* and associated reefs has been reduced by intensive trawling.[2,44] The impact from bottom-trawling on fragile deep-sea habitats results when the trawl doors and the net sweep scrape along the seabed, removing epibenthic organisms and disturbing otherwise stable substrate.[28]

35. Less is known about the state of cold-water corals and other sensitive deep-sea habitats in the Pacific and Indian Oceans. However, it is known that between 1969 and 1975, some 1,800 trawlers fished pelagic armourhead (*Pseudopentaceros richardsoni*) to commercial extinction on a few seamounts in the south-east Emperor-Northern Hawaiian Ridge system,[45] and in 1981 more than 100 vessels were involved in coral fishing on central north Pacific seamounts.[46]

(c) Bottom-set longlines

36. Researchers have found visual evidence of damage inflicted on coral habitat (e.g., broken coral heads and trails of snagged-off corals) when bottom-set longlines and tub-trawling were hauled. Lost longline and gillnet gear was recorded by research vessels on the Mid-Atlantic ridge.[47]

(d) Bottom-set gillnets

37. In sensitive habitats, such as Porcupine Seabight and Rockall Trough, physical damage may be caused by anchors and weights, as well as by lost gillnets which continue to catch fish and become entangled on coral.[27] Video surveys of Thérèse Mound off Ireland show lost gillnet and tangled net gear on the reefs.[48]

(e) Pots and traps

38. It is believed that while there can be impact due to snagging when pots and traps are launched and hauled, the damage is probably much less than with other fishing gear.[27]

(f) Abandoned gear

39. Abandoned gear has numerous adverse effects that have been described in earlier reports. It is estimated that 30 per cent of sea-based sources of marine litter come from the fishing industry and that hundreds of thousands of tons of non-degradable fishing nets are present in the world's oceans (A/60/63, paras. 240 and 247). Recently, following preliminary results of an international investigation on shelf edge and deep-water fixed net fisheries to the west and north of the United Kingdom and Ireland, around Rockall and Hatton Bank, ICES indicated that: "if the indirect evidence and preliminary data reflect the real state of these fisheries, ghost fishing, discarding of catches and netting is a graver problem than anticipated."[49]

2. Impacts on vulnerable marine ecosystems

40. A large number of studies have documented the effects of mobile fishing gear, including the loss of habitat complexity, shifts in community structure and changes in ecosystem processes.[28,50] Changes in size structure, genetic composition,

localized depletions and alteration of trophic structures in ecosystems have also been shown.[51]

(a) Impacts on target species

41. Scientists have identified two different categories of deep-water fish species: (a) widespread species that occur at relatively low density in almost any location of their geographical distribution, such as the roundnose grenadier, and (b) seamount-associated species that form dense aggregations in some particular habitats or at some time and have a very low density elsewhere. Worldwide, 60 to 70 species of fish, shellfish and precious corals are harvested from seamounts.[52] The majority of the catch of bottom-dwelling species on the high seas is taken by bottom-trawls. Most high-seas bottom-trawl catch over the past several years has consisted of roundnose grenadier, smoothheads, blue ling, orange roughy, alfonsinos, northern prawns, redfish, Greenland halibut, roughhead grenadier and hakes.[53]

42. Experience shows that some deep-sea species with life history strategies characterized by long lifespans, high age at maturity and slow growth (e.g., orange roughy, blue ling) can be depleted very quickly and recovery will be slow (see A/59/62/Add.1, para. 204).[54] Regeneration and growth are so slow that abundance does not increase in the depleted populations in the short or medium term. The body shape of many deep-water fish, combined with a high age/length at maturity, often means that there can be a high fishing mortality of immature fish. Some species, such as blue ling, orange roughy, red sea bream and alfonsinos, aggregate in shoals, often associated with seamounts, and the fisheries have high catch rates once the shoals are located (A/60/189, para. 119). Localized sub-units of the population can be quickly depleted by fisheries, even within a single season. Sub-units of some species (e.g., red sea bream, blue ling and orange roughy) are known to have collapsed in some areas covered by ICES.[55]

43. Since deep-water species are adapted to an environment where disturbance may be weaker or rarer than in the more shallow water ecosystems, adult survival rates may be high and fecundity rates may be lower. Such life history parameters make these fish very vulnerable to intensive fishing. A reduction of adult biomass by fishing may have a stronger negative effect on deep-sea fish species than for species living on the shelf.

44. Owing to the aggregating characteristics of some deep-sea fish species around marine habitats, such as seamounts for feeding or spawning purposes, the yield per unit effort can be very high. Most fisheries on seamounts often follow boom and bust cycles. Most of these aggregating species are easily fished towards depletion,[2] sometimes within one season. For many species, the recovery of such stocks takes several decades.[56]

45. Specific examples of rapid depletion of deep-sea fish stocks due to overfishing are set forth below:

(a) Rock lobster (*Jasus tristani*) on the Vema Seamount was seriously depleted shortly after discovery in the 1960s, and took 10 years to recover only to be overexploited again;[57]

(b) Slender armourhead (*Pseudopentaceros wheeleri*) populations over the southern Emperor seamounts and the seamounts in the northern Hawaiian Ridge were severely overfished from the late 1960s to the mid-1970s. Catches dropped

from an estimated 30,000 tons in 1976 to only 3,500 tons in 1977. It is thought that intense fishing pressure coupled with the rather complex life history of this fish contributed to its commercial extinction;[58]

(c) New discoveries of orange roughy (*Hoplostethus atlanticus*) stocks were typically fished down to 15 to 30 per cent of their initial biomass within five to ten years on seamounts off the coasts of New Zealand and Australia;[59]

(d) Precious corals, highly valued for jewellery items and ornaments, have been extensively harvested from the Emperor-Hawaiian Seamounts. For example, in 1983 around 70 per cent of the world's harvest of red coral came from these seamounts, amounting to about 140,000 kg. Red, pink, gold, black and bamboo corals have all been depleted from Mediterranean seamounts.[60] As these corals are slow-growing, with very low levels of natural mortality and recruitment, they are highly vulnerable to overfishing;

(e) Aggregations of alfonsinos on seamounts in the North Atlantic were detected in the late 1970s.[61] Initially, the total stock of alfonsinos was estimated to be relatively small (50,000-80,000 tons). Intense fishing has now significantly reduced the stock;[49]

(f) North Atlantic and Mid-Atlantic Ridge fisheries for orange roughy have recently decreased as a result of overfishing and low profit levels;[56]

(g) The impact of fishing on the bottom fauna (e.g., corals) around the Azores is poorly known but likely to occur, despite the use of more static gear such as bottom-set longlines.[2] Local demersal fish depletion around some islands in the Azores (e.g., S. Miguel, Terceira, Faial) is already evident, based on data collected during research longline surveys since 1995;[20]

(h) Concerns also have been raised with regard to sequential depletion and underreporting of catches from international waters of goldeneye perch (*Beryx splendens*), declines in landings of Great silver smelt (*Argentina silus*) and overfishing on spawning aggregations of blue ling (*Molva dypterygia*).[49]

(b) Impacts on non-target and associated species

46. By-catch and discarding are a common problem in all deep-water fisheries. Certain types of gear may cause excessive by-catch, especially if preventive or mitigating measures are not taken. As noted above, in some areas and for some species, entanglement or smothering in discarded fishing gear can also be a problem. Affected by-catch species include not only benthic invertebrates and fish species, but also migrating cetaceans, seabirds and deep-sea sharks. In the area covered by ICES, it has been reported that many more species were discarded from trawling operations than longline fishing.[62]

47. Cetaceans and sea turtles are also impacted by fishing activities. Entanglement in fishing gear is common, and cetacean by-catch is a significant problem. By-catch of marine mammals is known to occur in some trawl fisheries (particularly large, high-speed pelagic trawls) and to a lesser extent in longlines (A/CONF.210/2006/1, para. 127). Sea turtle by-catch in trawl gear has been reduced with the use of turtle-excluding devices. Turtle by-catch in gillnets, shrimp nets, trawls, set nets, traps and longlines is also problematic, although changes in hook shape and bait type are showing promising results (A/60/63/Add.1, para. 139).

48. Many seabird species spend the majority of their lives foraging for food on the high seas, coming ashore only for short periods to breed. Pelagic and demersal longlining fisheries are the largest threat to seabirds. Seabirds with low reproductive rates are sensitive to additional sources of mortality (A/60/63/Add.1, para. 138).

49. At least 10 species of sharks are discarded in directed longline fisheries for ling and tusk.[63] Given that deep-water sharks characteristically have low fecundity and long lifespans, they are particularly vulnerable to overfishing. In the North Atlantic, ICES reports declines in catch per unit effort of *Centroscymnus coelepis* and *Centrophorus squamosus*.[64]

(c) Impacts on benthic ecosystems

50. Deep-sea habitats are particularly sensitive to anthropogenic disturbance due to the longevity, slow growth, low reproductive rates and endemism of the individuals that structure the habitat, their susceptibility to increased sedimentation, their fragility and limited ability to recover from physical fragmentation. A large number of studies have documented the effects of mobile fishing gear on benthic habitat, including the loss of habitat complexity, shifts in community structure and changes in ecosystem processes.[28,65]

51. Fisheries exploitation has spread from coastal areas to the open ocean rapidly in recent decades.[25] Increased fishing activity increases the impacts on benthic environments in offshore areas. With the destruction of coral habitat resulting from fishing activity there is a decrease in abundance and diversity of associated fauna.[29] On Georges Bank, undisturbed gravel habitat had consistently higher abundance, biomass and species diversity than fished sites.[66] Coral-dominated sites were compared with heavily fished sites and it was found that biomass at the coral-dominated sites had a sevenfold higher mean sample biomass than at heavily fished sites.[67] Highly trawled and lightly trawled areas within the Monterey Bay National Marine Sanctuary, off California in the United States, showed a difference in structural complexity of the areas. More trawl marks and broken shells were evident in the highly trawled area.[68] That translated into significantly more abundant epifauna being found in the lightly trawled area. Ultimately, disturbance to coral communities reduces sea floor habitat and the species that use the habitat.[2]

52. A number of studies provide evidence of damage to deep-sea benthic communities. For example, damage to benthic invertebrates on seamounts by fishing activities has been well documented.[59,69] Also impacted are deep-water precious corals which often occur in the area of seamounts. Those corals, with their slow growth rates and often low levels of recruitment, if depleted, coral community recovery could take centuries. Pieces of scleractinarian corals were widespread as by-catch along the European continental margin from France to the Norwegian Arctic.[39] Of particular note, pieces of up to 1 m^2 were caught in trawls along the shelf break west of Ireland. Some of these coral fragments were carbon dated and estimated to be over 4,000 years old. Both Canadian and United States fisheries reported hauling up coral in their catches.[37,70]

53. Another impact of trawling on benthic communities results from the suspension of sediments which occurs during the fishing process (A/60/189, para. 120). That may bury organisms and their food supply. It also clogs the filters of suspension feeders like sponges.[70] Some species of sponge are so fragile that they totally disintegrate when hit by the pressure wave from trawl gear.[70]

54. Comparative studies have shown clear differences in benthic community structure in trawled compared to untrawled areas.[71] A coral by-catch of 3,000 kg was documented from six trawls on seamounts off Australia that had not previously been fished for orange roughy (*Hoplostethus atlanticus*), whereas the by-catch levels at heavily fished seamounts amounted to about 5 kg for 13 trawl hauls.[72] The by-catch of coral in the first two years (1997-1998) of bottom-trawling for orange roughy over the South Tasman Rise reached 1,762 tons but was quickly reduced to only 181 tons in 1999 to 2000.[73] It also was reported that the most heavily fished seamount containing reef-building coral, *Solenosmilia variabilis*, where fishing for both orange roughy and oreos (*Pseudocyttus maculates, Allocyttus niger*) took place, eventually consisted of over 90 per cent bare rock at most depths. Biomass and species richness were both drastically reduced and it was anticipated that should community recovery occur, it would likely be a lengthy process.[8]

55. As a general comment, it may be observed that although trawls have immediate and short-term visual effects on the physical structure and the biodiversity of many highly structured vulnerable habitats (e.g. coral reefs, seagrass beds), the long-term effects of bottom-trawling on the less structured habitats that cover the vast majority of the oceans seabed (e.g. soft substrates) are very poorly documented, although they might be considerable. Overall knowledge on the subject is far from conclusive.

56. It should be noted that the impact of bottom-trawling could be reduced by requiring a maximum size of discs or roller gear on the trawl footrope, which would de facto impede the work of trawlers on most vulnerable fishing grounds.

III. Actions by States to address fishing practices that may have an adverse impact on vulnerable marine ecosystems

A. Introduction

57. States have adopted a range of approaches and measures to address the impacts of destructive fishing practices on vulnerable marine ecosystems both in areas under their jurisdiction (subsection A) and in areas beyond national jurisdiction (subsection B). Data collection and research is ongoing (subsection C).

58. Except where indicated, the present section summarizes information provided pursuant to paragraphs 66 to 69 of General Assembly resolution 59/25 and paragraph 73 of resolution 60/31 by the following States and entities: Australia, Brazil, Canada, Chile, Cyprus, Czech Republic, European Community, Indonesia, Japan, Latvia, Malaysia, Malta, Mauritius, Mexico, Namibia, New Zealand, Norway, Oman, Palau, Portugal, Republic of Korea, Saudi Arabia, Tunisia, United Kingdom, United States and Uruguay.

59. A number of States, including Canada, Japan, Namibia and Portugal, expressed concerns about the assumption that all bottom-trawling is detrimental to marine ecosystems. They emphasized that it must be recognized that bottom-trawling plays a significant role in the development of and supply of food to coastal communities. These States pointed out that technological advancements have made bottom-trawl nets a much more selective fishing gear. They further noted that bottom-trawling is a

highly efficient harvesting method, which should, however, be carefully managed if the fishery is to be sustainable.

B. Actions by States in areas under national jurisdiction

60. According to the FAO Technical Guidelines for Responsible Fisheries[1] a set of measures is necessary to address the impacts of fishing on vulnerable marine ecosystems, including the application of the precautionary approach and ecosystem-based management measures, as well as measures to prevent overfishing, minimize by-catch and discards in directed fisheries, prevent habitat degradation, monitor and enforce management actions, address illegal, unreported and unregulated (IUU) fishing, and collect comprehensive data and advance research.

61. At the national level, the above approaches and measures have been adopted by States within the general framework of ocean management policies, fisheries-related legislation or strategies related to biodiversity.

1. Application of the precautionary and ecosystem approaches to fisheries management

62. It appears from the submissions of States that an increasing number of them have adopted, amended or are in the process of amending their legislation to incorporate precautionary and ecosystem approaches in fisheries management.

63. For example, pursuant to the Canadian Oceans Act, when ecologically significant areas are considered sensitive to certain threats, management tools can be used to ensure that these areas continue to play their ecological role. To achieve integrated management, Canada has defined 19 ecoregions which serve as the ecological reference base for ecosystem-based oceans management decisions. Within these ecoregions, integrated management processes have been initiated in five large oceans management areas. As part of a scientific review, Canada has begun identifying ecologically and biologically significant areas within each of the planning areas, some of which may be sensitive to particular threats posed by human activities and require special management measures to achieve the protection required to maintain their ecological character.

64. In order to implement its Biodiversity Strategy, New Zealand has committed itself to creating a network of marine-protected areas that represent the full range of New Zealand's ecosystems and habitats by 2020. The desired outcomes are habitats and ecosystems in a healthy functioning state, recovering degraded habitats and informed, controlled and ecologically sustainable harvesting (see para. 96).

65. New Zealand has also developed a Strategy for Managing the Environmental Effects of Fishing, which establishes the framework, including principles and processes, for the setting of environmental standards that specify the limits of acceptable environmental effects of fishing on the marine environment.

66. Mexico has developed ecosystem impact indicators of shrimp trawl fishing in the Gulf of California and requires environmental impact statements from shrimp trawlers.

67. The legislation and/or management measures adopted by Canada, Cyprus, Mexico, Norway, Portugal, the Republic of Korea, Saudi Arabia, the United States

and Uruguay provide for the application of some form of the precautionary approach to fisheries management (A/CONF.210/2006/1, para. 150). The United States has issued technical guidelines for the precautionary approach. In Canada, considerable work has been done in recent years to introduce limit reference points and other elements of the precautionary approach in a number of fisheries. A general framework incorporating the precautionary approach is being finalized, which initially will be applied broadly to single species, with by-catch and ecosystem factors to follow.

68. The legislation of Indonesia establishes fisheries management areas based on ecosystem characteristics and on the distribution of fish resources in each area. In its fishing zones, also established pursuant to Indonesian legislation, various restrictions on gear (such as mesh size regulations and net length) and practices (such as the use of fish aggregating devices) apply.

69. Some policies and legislation have provided for stakeholder participation in the identification and implementation of measures to protect marine ecosystems. Under the Canadian Oceans Act, various stakeholders cooperate in the planning and management of ocean activities, and in identifying ecologically and biologically significant areas and applying appropriate management measures to ensure the long-term health of ecosystems. In New Zealand, the Joint Marine Protected Area Policy and Implementation Plan will bring scientists, marine users, indigenous people and the broader community together to plan for the protection of marine habitats and ecosystems. In Australia, community support for the new zoning plan of the Great Barrier Reef Marine Park is being increased by building closer relationships between the Great Barrier Reef Marine Park Authority and community members through the Community Partnerships Programme.

2. Actions to prevent overfishing

70. Most States reported having put in place national legislation to promote sustainable fisheries, including by adopting measures to prevent overfishing. These include a variety of measures, such as licensing, total allowable catches and quota schemes, gear and vessel restrictions, area and seasonal closures and the establishment of marine-protected areas.

71. It has been widely recognized by States that a critical step towards tackling the problem of overfishing and its impact on sensitive habitats is through capacity reduction. For example, Australia, Canada, the European Community, Japan, Norway, the United Kingdom and the United States have employed a variety of measures to reduce capacity, such as vessel buy-back schemes to reduce excess fishing capacity (paras. 161-166).

72. In Malaysia, initial steps have been taken through the enactment of a moratorium on new fishing licenses for coastal fisheries and introduction of an exit plan for the retirement of fishing vessels. Fishermen are also provided with alternative employment and livelihoods, such as tourism or aquaculture. Malaysia also participates actively in the development and identification of indicators for sustainable development and management of fisheries.

73. Uruguay reported managing its fisheries by closing fishing grounds that are considered to be fully exploited, establishing catch limits for each fishing vessel and target species, and defining fishing zones for different categories of fishing vessels.

3. Actions to address by-catch and discards

74. By-catch and discards are a serious problem that hinders the sustainability of fish stocks and marine species.[74] Most States that provided submissions for the present report have adopted measures to address the problem.

75. States have adopted by-catch reduction measures intended to reduce the impact on threatened or endangered species and non-target fish species. Such measures include modifications and/or restrictions on gear or fishing methods including, inter alia, mesh size restrictions, net length requirements, fishing depth requirements, minimum and maximum size limits, turtle-excluding devices, by-catch reduction devices, juvenile and trash excluder devices, requirements for reporting lost gear and restrictions on fishing during spawning seasons or at certain times of day, when threatened or endangered species are present or in areas where spawning or nurseries are known to occur.

76. In order to monitor by-catch in areas under its jurisdiction, Canada requires that all catches of authorized species be retained, landed and reported. By-catch of prohibited species must also be recorded. A specific requirement for mandatory landing of all groundfish was put in place as a result of historic high incidental catch of groundfish in the north-east coast scallop fishery. Consistent with an ecosystem approach to fisheries management, the total allowable catch for groundfish in Canada now includes a quota for yellowtail flounder, cod and haddock caught incidentally in the scallop fishery, which has resulted in better overall accounting of total groundfish caught directly or as by-catch, and has served scientific stock assessment purposes. Additional measures include a requirement to use the Nordmore Grate in shrimp fisheries, and toggle and chain regulations for east coast shrimp trawls. With such regulations, while the trawl rollers are in contact with the ocean floor, the trawl itself is above the ocean floor by about 72 cm. The measure reduces by-catch of bottom species and keeps the net off the ocean bottom.

77. The United States has begun implementing a national by-catch strategy to reduce catch of non-target species, along with a number of other regulatory measures to ensure the application by fishing vessels of the strategy, such as measures to reduce by-catch of sea turtles and seabirds.[75] Uruguay indicated that it had limited by-catch of non-target species by establishing maximum authorized ceilings for the volume of each species unloaded. It has also established a national programme to monitor and record shark by-catch in fisheries. Malaysia has adopted legislation to protect the whale shark. In New Zealand, the use of selective fishing gear has been promoted through financial incentives (A/CONF.210/1, para. 186).

4. Actions to prevent habitat degradation

78. Several types of measures have been adopted to address the adverse impacts of fishing on vulnerable habitats. They include restrictions or prohibitions on certain fishing practices or types of gear, area management, and development of less destructive gear.

79. Brazil, Malaysia, the United States and Uruguay have prohibited several types of destructive fishing practices, such as electric fishing, and the use of explosives or other toxic or poisonous substances. Indonesia has adopted a general prohibition on the use of chemical and biological substances, explosives and certain gear or fishing

methods which may harm or endanger the sustainability of fish resources and/or the environment within its fishery management areas.

80. Several States have prohibited bottom-trawling either entirely within their EEZs, at certain depths or within certain distances from their coastlines. Japan, Mauritius, Palau and Saudi Arabia prohibit bottom-trawling in their EEZs. Brazil prohibits bottom-trawling at depths greater than 600 m. Under European Community regulations, bottom-trawl nets are prohibited within three nautical miles from the coast or at depths less than 50 m where this depth can be reached at a shorter distance. As a result, bottom-trawling is restricted in the waters off the Azores, Madeira, the Canary Islands and Malta. In the Gulf of Riga, Latvia has banned the use of bottom-trawls and other active gear at depths less than 20 m. Mexico reported that, by virtue of limited technical capacity, most shrimp trawling only took place in depths less than 200 m, and therefore only had limited impacts, if any, on deep-sea habitats. The United States indicated that legislation was pending to prohibit bottom-trawling within its EEZ in areas where there are vulnerable deep-sea coral and sponge ecosystems. Indonesia has restricted bottom-trawling in several areas in its EEZ, but allows the practice in areas where the substrate is muddy, sandy and flat and where it is believed that the impact of such gear will be limited.

81. Under European Community regulations, the deployment of bottom-set nets at depths greater than 200 m in some areas[76] is prohibited. In addition, oceanic drift trammel nets, driftnets and gillnets in deep-sea waters less than 200 m deep are prohibited in the Azores, Madeira and the Canary Islands. As a result, Portugal has banned oceanic drift trammel nets inside its EEZ. Cyprus has amended its fisheries legislation to restrict the use of certain types of gear.

82. In Oman, specific concession areas, which are at least 10 nautical miles from the coast and in waters at least 50 m deep, are assigned to benthic fishing vessels. In Malaysia, under a zoning system, trawling zones are based on vessel tonnage, trawling is prohibited within five nautical miles from the shore and a quota and licensing system for trawlers has been established. A national campaign to redeploy or relocate trawler fishermen to other economic activities such as aquaculture or ecotourism has been launched. Sweden prohibits trawling in near-shore areas, with the exception of environment-friendly trawl gear in less sensitive habitats, and prohibits beam trawling and shellfish dredging. Denmark prohibits trawling within three nautical miles and imposes restrictions up to 12 nautical miles. Indonesia prohibits pair-trawling within its territorial waters. In Saudi Arabia, regulations are in place to control bottom-trawling of shrimp in the waters under its jurisdiction.

83. In some States, less destructive fishing gears have been used or are being developed to reduce the impacts of fishing on bottom-habitats. The Danish Institute for Fisheries Research, together with fishermen, developed a smaller, lighter mussel dredge than the traditional one. In Mexico, traditional trawl boards made of wood and steel have been replaced by smaller steel (or steel and plastic) hydrodynamic trawl doors. Adapted trawl nets have been redesigned with trawl tows (double bottom-rigging) for shrimp fishing with bigger boats.

84. Measures to address lost or abandoned gear and related marine debris have been adopted by the European Community, New Zealand, Norway, Saudi Arabia and the United States. The United States has established an inter-agency marine debris coordinating committee to allow consideration of the issue from all sectors and

sources. The European Community funds initiatives by operators to recover lost gear and requires compilation of all necessary information to initiate a programme of lost gear recovery. Several States, including New Zealand, Saudi Arabia and the United States have developed systems to retrieve lost gear and nets (A/CONF.210/2006/1, para. 194).

85. Seasonal and/or spatial area closures have been established to complement restrictions on practices and gear. Such closures have been used by States to better protect habitats, benthic communities, juvenile or spawning fish aggregations or endangered species. Several submissions, including those of Australia, Canada, the European Community, Malaysia, New Zealand and the United States, referred to the establishment of categories of marine-protected areas where restrictions on gear and practices apply.

86. Uruguay has established protection measures in fish breeding grounds. Brazil has put in place temporal closures to prohibit fishing during periods of spawning and reproduction. During such periods, fishermen are provided with unemployment benefits to discourage fishing other than with traditional means.

87. Canada closed three areas to protect sponge reefs off its west coast and two deep-sea coral habitats off its east coast (e.g., the Gully and the North-east Channel). Since 1994, under European Community regulations, fishing with bottom-trawl nets above the Posidonia Meadows is prohibited in the Mediterranean. Closure of the maërl beds and coralligenous habitats has also been proposed. Bottom-trawling has been prohibited in the Hecate Seamounts, the Faraday Seamounts, Reykjanes Ridge (partem), the Altair Seamounts and the Antialtair Seamounts.

88. Indonesia has implemented a trawl ban since 1980 in the Malacca Straits and northern coast of Java, and bottom-trawls do not operate in areas where seamounts are found, including in the Gulf of Tomini, identified as a potential hydrothermal resource, the Sulawesi Sea and the Banda Sea.

89. In the United States, 388,500 km^2 have been closed to bottom-trawling and, in specific areas, all gear that come into contact with the sea floor are prohibited. Bottom-fishing and anchoring are also prohibited on two near-shore Alaskan pinnacles that have vulnerable ecosystems similar to seamounts. The use of bottom-trawls and bottom-set gillnets also is prohibited in a nearly 4 million km^2 area around the United States Pacific Islands. In the United States, trawling is prohibited off south-east Alaska (134,700 km^2 closure) to protect red tree corals, and in other areas off Alaska (129,500 km^2 closure) to protect sensitive benthic habitats, including emergent epifauna such as bryozoans and sponges, used by crabs and other species. In 2004, two submarine canyon areas off New England were closed to gillnetting and trawling to protect corals. Nine areas are under consideration as potential habitat areas of particular concern, while several such areas have already been established to protect vulnerable ecosystems, including by the prohibition of certain types of gear in those areas. Recently, the north-west Hawaiian Islands and the surrounding United States waters have been declared a national monument, and are to be protected from all extractive uses.

90. In Germany, only the use of passive gear is permitted in national parks and conservation areas.

91. In Australia, one of the outcomes of the marine bioregional planning process was the development of a comprehensive and large scale network of marine-

protected areas throughout its EEZ. As a result, a national representative system of marine-protected areas should be completed by 2012. Marine bioregional plans will result in a comprehensive management and conservation regime for each region, and fishing methods that impact significantly on sea-floor habitats or which otherwise pose a serious threat to biodiversity will be excluded from all zones in the network.

92. The recently completed design process for representative marine-protected areas in Australia's south-east marine region resulted in approximately 226,000 km^2 being identified as marine-protected areas and nearly 80 per cent of that area being closed to all forms of commercial fishing. Bottom-trawling and other fishing methods that destroy sea-floor habitats will not be permitted in any of the zones proposed for the south-east network. The majority of seamounts in Australia's south-east region are included in the proposed areas and several of the 13 new areas in the south-east network adjoin Australia's EEZ. In addition, the Great Barrier Reef Marine Park was re-zoned in 2004 with the effect of increasing the level of "no-take" zones from less than 5 per cent of the Marine Park to over 33 per cent. "No-take" zones prohibit extractive uses like fishing and collecting. In addition, the re-zoning further protected soft seabed habitats by increasing the amount of area closed to bottom-trawling to 28 per cent. That, when combined with other zone types, offers protection from trawling to 66 per cent of the Marine Park. In addition, marine parks have been declared in the Macquarie Island and Heard Island and McDonald Islands regions, where strict controls are placed on fishing activity. The Macquarie Island Marine Park comprises almost one third of the Australian fishing zone around Macquarie Island. In 2002, the Heard Island and McDonald Islands Marine Reserve was declared, 65,000 km^2 being set aside as a protected area managed mainly for science. Commercial fishing is not permitted in these waters, and an assessment will be undertaken in the future to determine whether all or part of the Conservation Zones, which are protected but where restricted fishing is permitted, should be included in the Marine Reserve.

93. New Zealand has closed 19 seamounts, covering 11.5 million hectares, for the purpose of biodiversity protection. New Zealand also is intending to establish a network of representative marine-protected areas by 2020, which would close 30 per cent of its EEZ and some areas beyond the EEZ to protect benthic communities. In the near term, New Zealand's goal is to protect 10 per cent of its EEZ by 2010.

5. Monitoring and enforcement

94. Most States provided information on monitoring and enforcement programmes. In a number of cases, programmes incorporate a combination of monitoring and inspection measures and sanctions.

95. Australia reported that it was the first State to implement a formal assessment of commercial fisheries on a national scale. In response to legislation requiring fisheries to minimize their catch of non-target species, mitigate interactions with protected species and to ensure the protection of critical habitats of protected species, all Australian Government-managed fisheries and export fisheries undergo a comprehensive independent assessment of fishery operations and management to determine whether the fishery is being managed in an ecologically sustainable way and to promote continuous improvement in environmental performance.

96. With regard to inspection and monitoring, observer programmes, log books, satellite monitoring, the use of vessel monitoring systems (VMS) are being used,

including by Canada, the European Community, Mexico, New Zealand, the United States and Uruguay. For example, in the United States, as a targeted measure, VMS usage is required since 2003 in the Oculina Habitat Area of Particular Concern for rock shrimp fishing vessels to enhance surveillance and enforcement of this habitat. Mexico indicated that it had stepped up inspection and monitoring measures to prevent trawling in protected areas and coral reefs, under its jurisdiction.

97. As far as IUU fishing is concerned, Chile, Namibia[77] and the Republic of Korea[77] have adopted a national plan of action to prevent, deter and eliminate such fishing. Chile has banned foreign flag vessels which fail to provide information on catches by fishing areas from entering its ports. Malaysia has developed a draft plan of action on IUU fishing, and indicated that joint enforcement with neighbouring States to combat IUU fishing was being carried out. In the case of New Zealand and the United States, should inspections establish that IUU fishing has occurred, landings and trans-shipments of catches are prohibited and violations are reported to the flag State of the vessel and the RFMO or the coastal State where fishing took place (A/CONF.210/2006/1, paras. 282-284).

98. Canada, the European Community, New Zealand, Norway, the United States and Uruguay indicated that either individually or through their participation in RFMOs, they carry out inspections when fishing vessels are docked in their ports or at offshore terminals. In particular, Uruguay indicated that inspections and checks were performed before vessels are allowed to sail and before they unload their catches. Latvia is strengthening fishing control and supervision, including through the development of traceability of caught fish.

99. A number of States, including Brazil, Canada, Indonesia, New Zealand and Palau, have established civil and criminal penalties for the use of destructive practices.

C. Actions by States in areas beyond national jurisdiction

100. Several submissions reported on measures adopted by States to address potentially destructive fishing practices in areas beyond national jurisdiction, including as a means of implementing their international commitments resulting from, inter alia, the United Nations Convention on the Law of the Sea, the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (1995 Fish Stocks Agreement), the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (FAO Compliance Agreement), and the FAO Code of Conduct for Responsible Fisheries.

101. Measures to address such practices have also been adopted as part of regional cooperation, including through RFMOs.

1. Domestic policies and legislation

102. Canada has developed an International Fisheries and Oceans Governance Strategy aimed at ensuring that an effective institutional framework for governance

and management of the high seas was in place to support the long-term conservation and sustainable use of biodiversity and resilient ecosystems.

103. Australia, Canada, the European Community, Japan, Mauritius, Namibia, New Zealand, Norway, Portugal, the United States and Uruguay have requirements for fishing vessels to obtain an authorization, licence or permit before engaging in high-seas fishing, which they consider as a measure to address destructive fishing practices (paras. 269-273).

104. The United States announced in 2005 that, as a matter of policy, it would not issue new permits to vessels flying its flag to fish on high-seas seamounts until consultations were held in accordance with domestic legislation to protect endangered species, and on other environmental impacts. The Australian Fisheries Management Authority is developing a policy on high-seas fishing by Australian operators to provide guidance for decisions relating to the issuance of high-seas permits.

105. Some States impose gear restrictions on their vessels operating on the high seas. For example, Japan requires its vessels licensed to fish on the high seas to adhere to mesh size regulations. New Zealand prohibits bottom-trawling and dredging in sensitive areas to protect benthic habitats in areas beyond its jurisdiction.

106. Owing to geographical and technical constraints, monitoring, control and surveillance on the high seas are of particular concern. Several States indicated that they require that their high-seas trawling vessels, inter alia, provide on-board observers, be equipped with VMS and submit catch reports. Port inspections are also required for high-seas vessels by a number of States. States have adopted measures to penalize non-compliance.

2. Actions by States at the regional and global levels

107. This section focuses on the promotion, by States, of measures to address the impacts of fishing on vulnerable marine ecosystems at the regional level, in particular through RFMOs. Most States indicated that they are members of one or more RFMOs. A number of them pointed out that they are cooperating non-members of some RFMOs.

108. The European Community and the United States indicated that they are collecting information on seamounts within the NAFO regulatory area, where deep coral ecosystems were identified as being potentially vulnerable to bottom-tending fishing gear, especially bottom-trawl gear.

109. On the basis of a European Community proposal in 2005, the General Fisheries Commission for the Mediterranean (GFCM) adopted two recommendations prohibiting the use of certain gear (see section IV). Tunisia indicated that it had endorsed the adoption of measures by GFCM to combat destructive fishing practices, as well as ICCAT conservation measures. Saudi Arabia cooperates with the Secretariat of the Gulf Cooperation Council to address bottom-trawling through the Regional Commission for Fisheries.

110. Several submissions highlighted the establishment of protected or closed areas. Australia supports developments within the FAO Committee on Fisheries to investigate the use of temporal and spatial fisheries closures, among other measures,

to achieve broader biodiversity conservation objectives on the high seas. Following a Canadian proposal during the September 2005 NAFO meeting, contracting parties agreed to take the first steps towards the protection of fragile undersea mountains or seamounts (see section IV). The European Community tabled a proposal within NEAFC to prohibit fishing in six sensitive habitats within the Convention area. Malta supported the establishment of fisheries restricted areas in order to protect deep-sea sensitive habitats within GFCM (see section IV).

111. In 2005, at New Zealand's urging, CCAMLR adopted a 10-nautical-mile fishing exclusion zone around the Balleny Islands archipelago in the Ross Sea. In 2006, New Zealand participated in an informal workshop with the Pacific Community to explore the impacts of bottom-trawling and protection of biodiversity on the high seas.

112. Several States, including Australia, Malta and Norway, indicated in their submissions that they had cooperated through RFMOs to address IUU fishing. In particular, lists of vessels presumed to have carried out IUU fishing have been established, measures to regulate trans-shipment by purse seine and longline vessels have been adopted, and the landing of catches caught in contravention with the rules established by RFMOs or other arrangements, including catches taken by nationals of States that are not members of the relevant organization, has been prohibited. Such prohibitions apply irrespective of whether the fish were caught in an area under the jurisdiction of a particular State or on the high seas.

113. Malaysia indicated that, even though it is not a signatory to the FAO Compliance Agreement, it provides information on landings and fishing vessels to regional and global bodies, including the Southeast Asian Fisheries Development Center, the Indian Ocean Tuna Commission (IOTC), and FAO. Uruguay indicated that it provides statistical information on its vessels operating in FAO areas 87 and 51, covered by RFMOs of which it is not yet a member.

114. Several States highlighted in their submissions their efforts to modernize or expand the coverage of existing RFMOs and create new ones. Canada stated that it advocated modernization to ensure that RFMOs manage marine living resources according to the conservation standards established by current international fisheries instruments. It also advocated expanding the competence of RFMOS to regulate fishing activities that may have adverse impacts on vulnerable marine ecosystems. Canada had hosted the Conference on the Governance of High Seas Fisheries and the United Nations Fish Agreement (St. John's Conference), in May 2005, which had resulted in the St. John's Ministerial Declaration, outlining actions required to modernize RFMOs on a global basis.

115. Australia and Mauritius indicated that they were actively involved in the development of the South Indian Fisheries Agreement (SIOFA) (see section VI). Australia, Chile and New Zealand are promoting the establishment of a new RFMO in the south Pacific to address the governance gaps on the high seas for non-highly migratory species (see section VI). Australia considers that that new RFMO should be based on the principles of the 1995 Fish Stocks Agreement, including the precautionary approach and an ecosystem approach to fisheries management. Australia also advocates the establishment of interim arrangements to ensure that, while the RFMO is being developed, fish stocks are managed in a manner that does not undermine the principles of sustainable fisheries management under which the RFMO is being negotiated and those outlined in the 1995 Fish Stocks Agreement.

The Republic of Korea indicated that it was engaged in regional efforts with Japan and the Russian Federation to regulate bottom-trawl fisheries in the north-western Pacific Ocean.

116. A number of States are cooperating at the bilateral and regional levels outside the framework of RFMOs. Malta indicated that it participates in the FAO subregional project on the "Assessment and Monitoring of the Fishery Resources and the Ecosystems in the Straits of Sicily". Mexico cooperates with the United States through bilateral cooperation programmes, covering the Gulf of Mexico and the Pacific, and participates in the Inter-American Convention for the Protection and Conservation of Sea Turtles.

117. Canada reported that it actively participated as a member in the work of the Ministerial-led Task Force on Illegal, Unreported and Unregulated Fishing on the High Seas, the recommendations of which include the development of a model RFMO based on best practices worldwide.

D. Data collection and research

118. Most submissions provided information on data collection and research programmes, in particular to better understand the impact of fishing on marine ecosystems.

119. In Australia, as part of its ongoing programmes to monitor the health of the Great Barrier Reef Marine Park, the Great Barrier Reef Marine Park Authority has been monitoring the effects of zoning on biodiversity. This includes the monitoring of target fish, their prey species and general reef condition, on a series of reefs in the new no-take zones and in zones open to fishing. The monitoring programme has been expanded to include specific assessments of the effects of the zoning on the biodiversity of coral reefs, shoal country and the seabed of the Marine Park in a number of areas. The social and economic parameters affecting the Marine Park are also monitored.

120. Brazil reported that its programme of evaluation of the sustainable potential living resources in the EEZ aims to create an inventory of the living resources in its zone and the environmental characteristics of their occurrence. Information is also collected on the distribution, seasonal variation, abundance and sustainable potential of a given resource, and a reference chart of climate and the physical, chemical and geological features of the marine environment is being established.

121. New Zealand has conducted a wide range of research such as biodiversity baseline surveys, reviews of marine ecosystems both inside and outside its EEZ and taxonomic studies, and has commissioned work to quantify the frequency and extent of bottom-trawling and dredging within its EEZ.

122. In Uruguay, the national authority responsible for all activities related to fisheries, the National Directorate of Water Resources, gathers scientific information on straddling fish stocks and cooperates with Argentina in research, evaluation activities and decision-making with respect to shared stocks through the Uruguay-Argentina joint technical commission. Latvia is improving organic and economic data collection.

123. The United States has conducted a number of fishery-related research projects to increase understanding of fish biology, habitat considerations and ecological relationships, including the role of humans in the marine environment. Work is ongoing on ecosystem-based management in the United States, where scientific research has been undertaken on the development of indicators of status of ecosystems (see A/CONF.210/2006/1, para. 201). Oman has undertaken a study of seven economically significant species and a study of the biology and fishery conditions of six economically important species of benthic fish in areas under its jurisdiction.

124. The European Community is undertaking extensive efforts to better understand the boundaries, structure and dynamics of marine ecosystems; the response of those ecosystems to human activities, with special emphasis on fishing, and how that response may be monitored by appropriate indicators and the study of biological interactions of small groups of fish stocks; and the forecasting of the effects of fishing when considering such interactions (see para. 201). The integrated study on oceanic seamounts aims at better assessing naturally occurring mechanisms of ecosystem functioning. The HERMES project (Hotspot Ecosystems Research on the Margins of European Seas), an interdisciplinary research project, aims to improve knowledge of ecosystem structure and dynamics by considering the variety and complexity of the continental margin environments, including deep-sea corals, chemosynthetic life and specialized fauna in canyons. The PROTECT and POORFISH projects aim at understanding the impacts of human activities on deep-sea corals in the North Sea, document fishery activities in deep waters of western Europe and identify mitigation measures, where needed. The project EXOCET/D intends to develop cost-effective, reliable and efficient technologies enabling progress in biodiversity and ecosystem science.

125. The United States has undertaken a project related to benthic ecosystems in the south-eastern United States Atlantic, where a regional geographic information system (GIS) for coral and benthic habitats in shallow and deep waters is being developed. Canada also undertook GIS mapping studies of marine ecosystems and is conducting assessments of biological and chemical-physical interactions. New Zealand has undertaken trophic modelling to understand the structure and dynamics of marine communities.

126. In 2006, Canada held a scientific advisory meeting to stimulate further research to assess the impacts of mobile fishing gear on the sea floor, and reviewed the conclusions of organizations such as ICES and the United States National Research Council on the effects of bottom-gear. Among its research efforts, Japan is currently examining the impact of bottom-trawling and the vulnerability of marine ecosystems both inside its EEZ and on the high seas. An initiative was approved in New Zealand to explore the impacts of bottom-trawling on benthic communities.

127. Since 1982, Brazil's National Policy for Marine Resources has provided for scientific research focused on the identification of new fishing resources, technologies and socio-economic aspects of fishing as well as improvements in aquaculture.

128. Australia, Brazil, Canada, the European Community, Malaysia, Mexico, New Zealand, Saudi Arabia, the United States and Uruguay have undertaken scientific research to reduce by-catch and discards. New Zealand has undertaken studies to increase understanding of the extent of mortality of seabirds, marine mammals, fish

and invertebrates and reduce incidental fishery-related mortality. The European Community, New Zealand, Saudi Arabia and the United States support studies and research aimed at reducing or eliminating by-catch of juvenile fish, and the European Community is researching how to minimize cetacean mortality (see para. 189). New Zealand and Canada have also undertaken research to reduce bottom-trawl by-catch. Malaysia reported on research to test environment-friendly gear such as the use of square mesh size and bobbins in trawl nets, and is also exploring the use of circle hooks as a means of reducing sea turtle mortality.

129. A number of States are engaged in research and data collection at the regional level. Malaysia has participated in a regional programme led by the Southeast Asian Fisheries Development Center, FAO and IOTC to improve capture fisheries data collection through the implementation of an integrated database and a nationwide networking computer system. Malta indicated that a pilot study entitled "The spatial pattern of fisheries demersal resources, environmental factors and fishery activities in GFCM Geographical Sub-Area 15 (Malta Island)" was being finalized.

IV. Actions by regional fisheries management organizations and arrangements with the relevant competence to address the impact of destructive fishing practices

130. The present section presents information on fishery conservation and management measures adopted by RFMOs to reduce potential impacts on vulnerable marine ecosystems. The summaries are based on the submissions from RFMOs unless otherwise indicated. Information was received from the following RFMOs: the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the General Fisheries Commission of the Mediterranean (GFCM), the Inter-American Tropical Tuna Commission (IATTC), the International Convention for the Conservation of Atlantic Tunas (ICCAT), the International Pacific Halibut Commission (IPHC), the International Whaling Commission, the North East Atlantic Fisheries Commission (NEAFC), the Northwest Atlantic Fisheries Organization (NAFO), the North Atlantic Salmon Commission (NASCO), the Organización Latinoamericana de Desarrollo Pesquero (OLDEPESCA), the South East Atlantic Fisheries Organization (SEAFO), the Western and Central Pacific Fisheries Commission (WCPFC) and the Western Central Atlantic Fisheries Commission (WECAFC).

131. RFMOs are developing strategies to enhance their effectiveness in addressing destructive fishing practices through efforts such as precautionary and ecosystem approaches, the reduction of by-catch and discards, the prevention of habitat degradation, the expansion of research programmes, and the improvement of monitoring and enforcement.

A. Measures to address the impact of destructive fishing practices

1. Measures to apply the precautionary and ecosystem approaches to fisheries management

132. CCAMLR reported that it continues to adopt and implement many precautionary management measures in the area for which it is responsible. Fisheries regulated under CCAMLR are subject to precautionary catch limits, and scientific uncertainty is taken into consideration in decision-making. CCAMLR is also pioneering efforts to manage marine ecosystems according to the precautionary approach, in order to ensure that new and exploratory fisheries do not develop faster than the ability of the Commission to evaluate their potential consequences (see para. 142). At the meeting of CCAMLR in 2005, the Commission decided to consider ways to achieve broader conservation objectives for the marine environment, including: identifying vulnerable deep-sea habitats, establishing marine-protected areas and addressing the call by the United Nations to take action on destructive fishing practices.

133. IATTC reported that it has revised its agreement to incorporate the precautionary approach in managing highly migratory fish stocks. The Commission has also adopted measures for species belonging to the same ecosystem or associated with or dependent upon target stocks, to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species and impacts on associated or dependent species, in particular endangered species (see para. 173). IATTC stated that, since the 1980s, it has taken into account scientific advice and acted in a precautionary manner in the absence of scientific information.

134. ICCAT reported that it recently established a Precautionary Approach Working Group and adopted resolutions calling for the monitoring of interactions between ICCAT fisheries and pelagic sharks, seabirds and sea turtles. In 2005, the ICCAT Standing Committee on Research and Statistics created a Subcommittee on Ecosystems for the purpose of integrating ecosystem-related monitoring and research activities that are required by the Standing Committee to fulfil its advisory role to the Commission. In so doing, the Subcommittee will serve as the scientific cornerstone in support of an ecosystem approach to fisheries in ICCAT.

135. NAFO started to implement the precautionary approach in 2005. In 2006, it also started a reform process to include, inter alia, an ecosystem approach.

136. NASCO reported that it has adopted a decision structure consistent with the precautionary approach to ensure that harvest levels for all fisheries for Atlantic salmon reflect the abundance and diversity of the exploited stocks.

137. NEAFC has updated its Convention with respect to biodiversity and ecosystem and precautionary approaches. The amendments are to "take due account of the impact of fisheries on other species and marine ecosystems".[78] NEAFC also noted that it requested ICES to provide advice in a fisheries and ecosystem context, in particular by including mixed fisheries considerations in management advice; the impact of environmental changes on fisheries; the impacts of fisheries on the ecosystem; and precautionary reference points for stocks. NEAFC reported that it had adopted interim closures pending an ICES study on the impacts of fishing on vulnerable deep-sea habitats.

138. OLDEPESCA reported that, in 2004, its Conference of Ministers decided to establish a working group to develop a Latin American plan of action for the implementation of an ecosystem approach to fisheries management, with the objective of conserving the structures and biodiversity of ecosystems. The plan of action would encourage the development of national plans, which could, inter alia, evaluate problems that could affect biodiversity, the physical deterioration of the habitat, biological and oceanographic factors which influence the stability of the system, and trophic changes in the food chain.

139. SEAFO reported that its management regime is designed to be science-based, to take into consideration an ecosystem approach and to apply the precautionary approach in the absence of reliable information.

140. WCPFC reported that it applies the precautionary approach in adopting conservation measures for south Pacific albacore tuna. Although there is little scientific evidence to confirm reports regarding the declining state of the species, the Commission capped vessel numbers actively fishing for it at 2005 levels and instructed its Scientific Committee to provide advice on the matter at the 2006 annual meeting, for a review of the measure.

2. Measures to prevent overfishing

141. At present, there is no global inventory of fish stocks, although FAO is developing the Fisheries Global Information System, which will fulfil that need.[79] According to recent analyses, approximately half of the world's target fish stocks are exploited close to the level that would provide maximum sustainable yield and one quarter are overexploited.[80]

142. CCAMLR, IATTC, ICCAT, NAFO and NEAFC manage fishing primarily through catch limits. For some species, RFMOs have adopted mesh regulations and/or minimum size limits, and seasonal and/or temporal area closures.

143. In the NAFO Convention Area, 25 stocks are targeted. Of these, 10 are under moratorium because of past overfishing.[81]

144. ICES advice provided to NEAFC indicated that many deep-sea species within its regulatory area may well be harvested unsustainably. Current regulations call upon States "not to exceed 70 per cent of the highest level of deep-sea fishing in previous years for the relevant species". In 2004, NEAFC adopted a 30 per cent reduction in effort in deep-sea fisheries in the regulatory area.[82]

145. In response to scientific advice that the bigeye tuna and yellowfin tuna stocks in the Convention Area are being overfished, WCPFC implemented specific conservation and management measures designed to reduce catch rates. The longline fishery, which targets the two species, has been capped at 2004 catch levels. The purse seine fishery, which does not target, but has a significant level of by-catch of juveniles of these species, has been capped at current effort levels and has had restrictions placed on the use of fish aggregating devices.[83]

3. Measures to minimize by-catch and discards

146. The most recent global assessment of discards estimates that the rate of discards is about 8 per cent for all marine fisheries within the EEZ and on the high seas.[53,74] Shrimp trawling discard rates range from zero to 96 per cent, with an

average of 62.3 per cent. The average discard rate for trawlers targeting demersal finfish is 9.6 per cent or 1.7 million tons, taken primarily within EEZs. By-catch of marine mammals also is known to occur in some trawl fisheries (particularly large high-speed pelagic trawls) and to a lesser extent on longlines.[73,74]

147. CCAMLR has implemented a plan of action to reduce seabird mortality in longline gear. By-catch limits were adopted such that a fishery must be closed when it reaches the total allowable catch level for the by-catch of a particular species, even if the total allowable catch for the target species has not been reached. To minimize the impact of trawling on non-target species in the fishery and on the seabed, and in accordance with its ecosystem approach, CCAMLR has prohibited the use of bottom-trawls in the fishery for mackerel icefish around South Georgia.

148. CCSBT is supported by a Working Group on Ecologically Related Species that provides information and advice on issues relating to species associated with southern bluefin tuna. CCSBT has taken measures to reduce the impact of southern bluefin tuna fishing on ecologically related species and by-catch, such as mandatory measures to mitigate seabird by-catch. Educational guides on by-catch species such as sharks and seabirds have been produced and distributed to southern bluefin tuna fishers.[83]

149. In 2005, GFCM adopted a resolution requesting its members to adopt management measures aimed at increasing the selectivity of demersal trawl nets, notably by immediate implementation of a 40-mm mesh size opening for the whole trawl net codend.

150. IATTC has adopted measures to implement the FAO International Plans of Action on Seabirds and Sharks and the Agreement on the Conservation of Albatrosses and Petrels. Since 1993, observers have collected data on fish discarded at sea by most vessels. Purse seine fishermen are required to promptly release, to the extent practicable, unharmed sharks, billfishes, rays, dorado and other non-target species, including sea turtles, and receive some training in release methods.[84]

151. ICCAT has minimum size limits and time and area closures for several tuna species and swordfish, as well as measures to encourage the release of live discards of billfish and bluefin tuna (+A/CONF.210/2006/1, para. 182). ICCAT has adopted measures to reduce by-catch mortality of north Atlantic shortfin mako shark, to prevent the practice of shark finning, and to improve the safe release of sea turtles caught in fishing operations.[85] In 2002, ICCAT adopted a resolution to implement the FAO International Plan of Action on Seabirds.[86]

152. IOTC has established a Working Group on By-catch to collect, collate and assess information regarding by-catch and to provide scientific advice to the Commission on by-catch matters. A resolution was adopted on shark by-catch, limiting the practice of shark finning, resolutions on the reduction of seabird and turtle by-catch and the establishment of data provision requirements for such by-catch.[83]

153. IPHC is engaged in several efforts to reduce the amount of halibut by-catch in north Pacific fisheries. In particular, it is promoting measures to address charter boat and recreation by-catch.[87] In 2005 it reported that halibut by-catch mortality in non-target fisheries was slightly reduced and was at its lowest level since 1987.

154. NAFO enacted several measures to reduce by-catch. Size limits were adopted for some of the species under management (e.g., Atlantic cod, American plaice, yellowtail flounder and Greenland halibut). A sorting grate with minimum bar requirements was recommended for the shrimp fishery in some specific areas. NAFO has adopted measures to ban shark finning.[88]

155. In 2005, NEAFC adopted a recommendation temporarily prohibiting the use of gillnets, entangling nets and trammel nets in the NEAFC regulatory area.

156. In December 2004, OLDEPESCA and its member States initiated a process to formulate national plans of action for the management of fishing capacity, for the conservation and management of sharks, for reducing incidental catch of seabirds in longline fisheries and for combating IUU fishing with the technical and financial assistance of FAO. The first phase of the programme was accomplished through three workshops which evaluated the situation in each country and prepared national work programmes. The second phase of the programme will include visits of international experts to each member country to provide technical guidances and advice and the third phase will consist of subregional workshops.

157. At its second meeting, WCPFC adopted conservation and management measures, in accordance with article 10 of the WCPFC Convention, relating to target and non-target and associated and dependent species.[83]

4. Measures for the prevention of habitat degradation

158. Some RFMOs have begun to take action to address the impacts of fishing activities on marine habitats, including by identifying sensitive habitats within their respective areas.

159. GFCM has called for restrictions on fishing in some areas in order to protect sensitive deep-sea habitats. GFCM adopted recommendations requiring members to prohibit the use of towed dredges in trawl-net fisheries at depths greater than 1000 m, and prohibiting the use of bottom-trawls and dredges in three specific areas to protect corals, cold hydrocarbon seeps and seamounts (i.e., *Lophelia* reefs off Capo Santa Maria di Leuca, Nile Delta cold hydrocarbon seeps and Eratosthenes Seamounts).

160. NAFO reported that it has requested its Scientific Council to provide advice on the development of criteria for determining areas of marine biological and ecological significance and the identification of such areas in the regulatory area.

161. NASCO has developed guidelines for habitat restoration under its Plan of Action for the Application of the Precautionary Approach to the Protection and Restoration of Atlantic Salmon Habitat. One of the first steps under the Plan of Action was to quantify existing habitat and, if possible, the extent of lost and degraded habitat.[89]

162. In 2001, NEAFC closed an area on the western slope of Rockall Plateau to bottom-trawling in order to protect juvenile haddock. In November 2004, NEAFC adopted a recommendation for precautionary, interim closures of five areas (the Hekate, Faraday, Altair and Antialtair seamounts, and an area of the South Reykjanes ridge) to apply to all fishing gears from 2005-2007, pending scientific advice from ICES. In 2005, in response to requests from NEAFC and OSPAR, ICES provided advice on seamounts, distribution of cold-water corals and other

vulnerable deep-water habitats. NEAFC concluded that current information was insufficient to support scientifically based closures.

163. SEAFO reported that it has established a working group to investigate, review, assess and evaluate, among others, the wider ecosystem impacts of fisheries activities, such as fishing gear effects on seabed and benthic ecosystems. The working group is to present its preliminary findings in October 2006.

5. Data collection and research

164. Several RFMOs are in the process of developing standards for observers and data collection by States to improve the quality and timely receipt of catch and effort data.

165. CCAMLR, IATTC, ICCAT, NAFO, NASCO, ICES for NEAFC and WECAFC conduct extensive research programmes. Research by CCAMLR, ICCAT, NAFO and IATTC is generally carried out by members through observer programmes and fishery surveys (acoustic and net surveys) to collect data on target species; fisheries catch and effort data; harvested species abundance; and biological, ecological and environmental data. Increasingly, most of those organizations are collecting more ecosystem data, such as by-catch and discard information on associated and dependent species taken in directed fisheries, as well as habitat information.

166. A total of 10 organizations, including CCAMLR, IATTC, ICCAT, NAFO and ICES, are collaborating through the sharing of information in programmes such as the FAO Fishery Resources Monitoring System. A website was established which provides a comprehensive, one-stop source of information on world fishery resources. The System includes data on catches, fishing fleet activities, stock levels and management practices.

167. CCAMLR has an Ecosystem Monitoring Programme which collects data on predator and prey species. Through the establishment of monitoring sites it attempts to distinguish between broad and local changes and to contrast differences between fished and non-fished areas.

168. GFCM has begun compiling economic data as part of its ecosystem assessments. The GFCM Subcommittee on Marine Environment and Ecosystems is conducting the following activities: interdisciplinary pilot studies for identifying and applying the principles of the ecosystem approach to the management of shared stocks at the subregional level, and testing ecological indicators in relation to spatio-temporal monitoring of fishing effort; coordination with projects on the monitoring and control of the impact of fishing on protected or endangered species; studies on species living at depths greater than 1,000 m and their relationship to three sensitive habitats; and studies on the interactions between cetacean species in fishery activities through possibly convening a joint workshop on the subject.

169. ICCAT is working with Japan, through the Japanese Data Improvement Project, to improve the collection of data from developing nation members. This project is addressed mainly to African, Central American and South American States.

170. IPHC maintains an active research programme designed to evaluate the ecological footprint of halibut fishing. IPHC provides data to its members on research and commercial fishing effort distribution, and identifies habitat and

establishes closed areas to protect vulnerable marine ecosystems, in particular deep-water corals and sponges, in its regulatory areas in the north-east Pacific Ocean. IPHC has planned a four-part research programme in the Bering Sea which will involve satellite tagging to address the lack of detailed knowledge on the timing of spawning migrations of halibut within its regulatory area.[90]

171. NAFO plans to amend its Conservation and Enforcement Measures to provide for the collection of biological data on seamounts in its convention area. NEAFC and NAFO developed a format and protocols for electronic exchange of fisheries monitoring, inspection and surveillance information (the North Atlantic Format) which has now also been adopted by CCAMLR and SEAFO. A working group consisting of members of the FAO Coordinating Working Party on Fishery Statistics and coordinated by NAFO is proposing amendments to the Format to ensure its usefulness in assessment and scientific research (see A/CONF.210/2006/1, para. 214).

172. NASCO established minimum standards for collecting catch statistics to improve the quality of data collected. NASCO also planned to conduct studies on predator-related mortality and the impact of acid rain on Atlantic salmon. It also developed a major public-private partnership, Salmon at Sea, to implement research cruises to study high-seas salmon mortality in 2008-2009.[91]

173. As a relatively new organization, SEAFO has recently established a Scientific Committee to assist with the collection of future scientific data within its regulatory area.[92] SEAFO has begun collecting data on catch and fishing effort as well as scientific data to support stock assessment. It also recognized the need to collect information on vulnerable ecosystems.[92]

B. Measures to ensure compliance

174. Most RFMOs with regulatory authority use a combination of the following to monitor compliance with and enforce management measures: logbooks, observers, VMS, and at-sea and port inspections by inspectors from members or inspectors representing the respective RFMOs. Standards for observers data, port inspectors and VMS operations are often lacking. As a result, some organizations are taking additional measures to expand and improve enforcement efforts.

175. CCAMLR has had an observer programme in place since the early 1990s requiring 100 per cent observer coverage on vessels fishing in its Convention Area. CCAMLR has also adopted a programme to address IUU which includes improved data collected from members, a requirement for vessels fishing in the Convention Area to be authorized by their flag States and a process to monitor the international toothfish trade.[93]

176. CCSBT has developed and continues to strengthen measures to address IUU fishing. They include the CCSBT Authorized Vessel List, trade information scheme and an Action Plan to deter fishing for southern bluefin tuna by non-parties.[83]

177. Both IATTC and ICCAT have adopted stronger measures to promote greater flag State compliance and to reduce IUU fishing, including stronger penalties and sanctions. IATTC instituted a comprehensive observer programme covering 100 per cent of large purse seine vessels and the prohibition of landings and trans-shipments of illegally caught fish.[94]

178. IOTC has adopted measures requesting member States to take steps to ensure that vessels flying their flags operate in a responsible manner consistent with their obligations under international law and the conservation and management measures adopted by IOTC. IOTC is continuing to strengthen measures to prevent, deter or eliminate IUU fishing operations.[83]

179. NAFO has developed a port inspection scheme requiring verification of species and quantities caught, cross-checking with the quantities recorded in logbooks, catch reports and inspection reports as well as verification of mesh size of nets on board and size of fish retained on board (see A/CONF.210/2006/1, para. 280). In its first compliance report in 2004, NAFO identified a number of quality and consistency problems with VMS, observer reports and port inspection reports.[84]

180. NEAFC, NAFO and GFCM have stepped up efforts to address IUU fishing. NEAFC has adopted detailed compliance schemes for both members and non-members. It also publicizes on its website a list of fishing vessels caught fishing in its regulatory area in violation of management measures. Since 2004, NAFO publishes an annual compliance report which includes information about violations and affected fish stocks. GFCM has established a Compliance Committee and has established a list of vessels presumed to have carried out IUU fishing activities in the GFCM area. ICCAT, IOTC and CCAMLR have implemented their own tracking systems in an effort to address IUU fishing (see A/CONF.210/2006/1, paras. 256-266).

V. Expansion of the competence of regional fisheries management organizations and arrangements

181. In accordance with paragraph 68 of General Assembly resolution 59/25, members of RFMOs or arrangements without the competence to regulate bottom-fisheries and the impacts of fishing on vulnerable marine ecosystems are called upon to expand the competence, where appropriate, of their organizations or arrangements in that regard.

182. In a number of RFMOs, such as GFCM, NAFO and NEAFC, steps have been taken or are being taken to amend their statutory instruments to address bottom-fisheries and the impacts of fishing on vulnerable marine ecosystems. They include the incorporation in their instruments of specific references, inter alia, to the precautionary and ecosystem approaches.

183. GFCM reported that, in order to operate more efficiently, its Commission amended its Agreement in 1997 to update it through including a reference to the precautionary approach.

184. In 2005, NAFO amended article 21 of its Conservation and Enforcement Measures to provide for the collection of biological data on seamounts in its regulatory area, and began to apply the precautionary approach. In 2006, NAFO is starting a reform process to include, among others, an ecosystem approach, and to strengthen the monitoring and control mechanisms.

185. NEAFC also reported that, in order to operate more efficiently, its Commission agreed in 2004 and 2005 on amendments to the NEAFC Convention as follows: in

2004 on a fast-track dispute settlement mechanism; and in 2005 on updating the Convention with respect to biodiversity and precautionary and ecosystem approaches. The new provisions include the obligation for the Commission to take due account of the impact of fisheries on other species and marine ecosystems.

186. WECAFC, though an advisory body, has proposed to the FAO Council that its statutes be amended to include the precautionary and ecosystem approaches to fisheries management.

VI. Establishment of new regional fisheries management organizations and arrangements

A. South Indian Ocean

187. FAO convened a conference for the adoption of the South Indian Ocean Fisheries Agreement, on 7 July 2006, at its headquarters in Rome. The new regional fisheries agreement has the mandate to conserve and manage non-tuna resources in areas beyond the national jurisdiction of coastal States in the southern Indian Ocean. Article 1(f) provides that the fishery resources falling under its competence are "resources of fish, mollusc, crustaceans and other sedentary species" within the relevant area, with the exclusion of highly migratory species and sedentary species subject to the fishery jurisdiction of coastal States pursuant to article 77 (4) of the Convention on the Law of the Sea. Article 7 provides that the Scientific Committee of SIOFA is entrusted, among other functions, with conducting the scientific assessment of the fishery resources and the impact of fishing in the marine environment, taking into account the environmental and oceanographic characteristics of the area.

188. SIOFA states that its objectives are, inter alia, to ensure the long-term conservation and sustainable use of fishery resources in the area through cooperation among the contracting parties, and to promote the sustainable development of fisheries in the area, in accordance with the objectives of the 1995 Fish Stocks Agreement. It lists the following principles as among those that would guide its conservation and management regime: (a) adoption of measures based on the best scientific evidence available; (b) adoption of measures which ensure that the level of fishing capacity is commensurate with the sustainable use of the fishery resources; (c) application of the precautionary approach; (d) management of fishery resources that maintain them at levels that are capable of producing maximum sustainable yields; (e) minimization of the harmful impact of fishing activities, fishing practices and management measures on the marine environment; (f) protection of marine biodiversity; and (g) recognition of the special requirements of developing States bordering the relevant area that are parties to the Agreement.

189. The Conference adopted a resolution on data collection and handling of information and data pertaining to high-seas fisheries, in an effort to better understand the fishery resources that fall under the competence of the new Agreement.

190. In addition, the Conference adopted a resolution on interim arrangements for the conservation and management of the high-seas fishery resources in the southern Indian Ocean, and called all interested States and regional economic integration

organizations to cooperate towards the conservation and management of the fishery resources covered by the Agreement, pending its entry into force. Interim arrangements include data collection relating to fisheries and fishery resources covered by SIOFA, facilitation of scientific assessments of stocks, development of standards for vessel authorization and arrangements for secretariat services.

191. In 2005, FAO announced the establishment of a new FAO regional fisheries body, the South West Indian Ocean Fisheries Commission (SWIOFC), in the south-western Indian Ocean region. The new organization is an advisory body under article VI. 1 of the Constitution of FAO and is mandated to promote the sustainable development and utilization of fishery resources in areas under the national jurisdiction of the States in the region, as well as to encourage regional cooperation to that effect.

192. SWIOFC aims to promote the application of the provisions of the FAO Code of Conduct for Responsible Fisheries, including the application of the precautionary approach and an ecosystem approach.

B. Pacific Ocean

1. South Pacific

193. The first international meeting on the establishment of the South Pacific Regional Fisheries Management Organization, convened by Australia, Chile and New Zealand, was held in Wellington from 14 to 17 February 2006.

194. The future RFMO would provide for the conservation and management of high-seas marine living resources in the south Pacific, other than species listed in Annex I of the Convention on the Law of the Sea. It would cover especially those fish stocks that are of commercial importance, but are not presently under any management regime. The future RFMO is expected to have competence to regulate deep-sea fisheries.

195. The establishment of this RFMO would address a governance gap for a wide area of high seas from the eastern edge of the south Indian Ocean, across the Tasman Sea and Pacific Ocean to the high-seas areas adjacent to the EEZ of South American States, where fisheries for certain straddling fish stocks and discrete high-seas fish stocks, including orange roughy, squid and mackerel, are subject to little or no control at all.

196. Among the main outcomes of the meeting was its decision to request the Chairperson of the meeting to develop a draft convention and draft interim arrangements for circulation to participants before the second meeting. The meeting also agreed to set up two informal working groups to support the Chairperson during the intersessional period. The first, the Science Working Group, was entrusted with gathering data on high-seas fish stocks in the future convention area as well as on the status of vulnerability of marine habitats. That information would place future meetings in a better position to introduce appropriate interim measures. The second working group, the Data and Information Working Group, was given a mandate to provide advice on data management, including confidentiality, security, collection and dissemination of data needs.

197. The meeting also agreed to consider at the next preparatory meeting the adoption of interim arrangements to apply prior to the entry into force of the future agreement, in the light of the information and advice provided by the working groups.

198. In addition, the meeting urged States, entities and territories to comply with their obligations under international law by taking such measures for their respective nationals and vessels flying their flag, engaged in fishing and other related activities, as may be necessary for the conservation and management of marine living resources falling under the proposed instrument. It further decided to cooperate for the establishment of interim target protection mechanisms for vulnerable marine ecosystems.

2. North Pacific

199. Regional cooperation is ongoing to establish a new RFMO to regulate bottom-trawl fishing in the north-western Pacific Ocean. Japan, the Republic of Korea and the Russian Federation held a meeting, from 11 to 13 April 2006, in Tokyo, to discuss the regulation of bottom-trawling in that area.

200. That first meeting allowed the three States to (a) exchange scientific information concerning high-seas bottom-trawling in the north-western Pacific Ocean; and (b) agree to cooperate on and strengthen the compilation, analysis and exchange of data on that fishing practice. They also agreed to develop interim measures for the management of bottom-trawling and the conservation of vulnerable marine ecosystems in the area. A second meeting is scheduled to be held in the summer of 2006.

VII. Conclusions

201. States and RFMOs have adopted a wide range of measures to address the impacts of destructive fishing practices on vulnerable marine ecosystems both in areas under their jurisdiction and beyond their national jurisdiction. They include: the management of fishing capacity; prohibition of certain fishing practices, in particular in areas with vulnerable ecosystems; restrictions on gear types and their use in certain areas; measures to address by-catch; measures to improve control by flag States over their vessels fishing on the high seas; measures to improve monitoring, control and surveillance, compliance and enforcement; measures to address IUU fishing; data collection and research; establishment of marine protected areas; and more extensive use of scientific advice. However, it is difficult to assess, from the submissions received, the extent to which such measures are being effectively implemented.

202. The precautionary and ecosystem approaches have received wide recognition and are starting to be incorporated into fisheries management policies in an increasing number of cases.

203. A number of RFMOs have amended or are in the process of amending their constituent instruments to incorporate precautionary and ecosystem approaches. New RFMOs, such as SEAFO, SWIOFC and WCPFC, and those which are being established in the south Indian Ocean and the south Pacific, incorporate or are

expected to incorporate the precautionary and ecosystem approaches as guiding principles for their fisheries management.

204. Some States have undertaken, or are in the process of undertaking extensive efforts to protect some fishery habitat areas within their national jurisdiction, in particular through the establishment of protected areas. However, this is not the case on the high seas, though deep-sea habitats in these areas are extremely vulnerable and require protection.

205. It appears that by and large fisheries that target newly discovered resources or those serving a new market opportunity proceed unregulated through their development period and beyond. Many fisheries are not managed until they are overexploited and clearly depleted and, because of the high vulnerability of deep-sea species to exploitation and their low potential for recovery, that is of particular concern for such stocks. That raises the question of the urgent need for interim measures in particular circumstances, pending the adoption of conservation and management regimes.

206. It follows from the submissions that modern technology provides better tools for monitoring, surveillance and control and enforcement. However, IUU fishing still represents a major problem.

207. It appears that information on fishing activities is not fully shared, thereby hindering monitoring, control and surveillance efforts. While RFMOs and many States have data collection systems, such systems are not coordinated, limiting efforts to share information. Improving coordination would greatly help efforts to conserve and manage fishing resources.

208. It appears that, beyond a first level of visual, short-term impacts on biodiversity, there is uncertainty on the long-term detrimental impacts of trawling on vulnerable marine ecosystems, and further research is urgently needed. In that regard, the application of the precautionary approach needs to be emphasized.

209. It follows from the submissions that there are still critical needs for habitat mapping in the deep sea, improved understanding of the impacts of various types of fishing activities and greater knowledge of ecosystem processes and functions. States and RFMOs are making extensive efforts in all of those areas. Continued support for such research is vital.

Notes

[1] FAO, *The Ecosystem Approach to Fisheries: FAO Technical Guidelines for Responsible Fisheries*, No. 4, Supp. 2 (Rome, 2003).

[2] ICES, *Report of the Working Group on Deep-water Ecology* (Copenhagen, 2005).

[3] Descriptions of Habitats on the Initial List of OSPAR Threatened and/or Declining Species and Habitats, Meeting of the OSPAR Biodiversity Committee, Bruges, Belgium, 16-20 February 2004.

[4] *Deep Sea 2003. An International Conference on Governance and Management of Deep Sea Fisheries. FAO Fisheries Report*, No. 772 (FAO, Rome, 2005); P. Weaver, D. Billett, E. Boetius, R. Danovaro, A. Friedwald and M. Sibuet, "Hotspot Ecosystem Research on Europe's Deep-Ocean Margins", *Oceanography*, Vol. 17, No. 4 (2004).

[5] B. Richer de Forges, J. Koslow and G. Poore, "Diversity and endemism of benthic seamount fauna in the south-west Pacific", *Nature*, No. 405 (22 June 2000), pp. 944-947.

[6] A. Rogers, "Molecular ecology and evolution of slope species", in *Ocean Margin Systems*, G. Wefer, D. Billet, D. Hebbeln, B. Jorgensen, M. Shuluter and T. Van Weering, editors (Heidelberg, Springer-Verlag, 2003).

[7] R. Wilson and R. Kaufman, "Seamount biota and biogeography", in *Seamounts, Islands and Atolls. Geophysical Monographs No. 43*, B. Keating, P. Fryer, R. Batiza and G. Backland, editors (Washington, D.C., 1987).

[8] J. Koslow and K. Gowlett-Holmes, "The seamount fauna of southern Australia: benthic communities, their conservation and impacts of trawling" (Report to Environment Australia and the Fisheries Research Development Corporation) (1998).

[9] C. Baker, B. Bett, D. Billett and A. Rogers, "An environmental perspective", in *The Status of Natural Resources on the High Seas*, WWF/IUCN, editors (WWF/IUCN, Gland, Switzerland, 2001).

[10] A. Rogers, "The biology of *Lophelia pertusa* (Linnaeus, 1758) and other deep-water reef-forming corals and impacts from human activities", *International Review of Hydrobiology*, Vol. 84, No. 4 (1999), pp. 315-406.

[11] B. Bett and A. Rice, "The influence of hexactinellid sponge (*Pheronema carpenteri*) spicules on the patchy distribution of macrobenthos in the Porcupine Seabight (bathyal NE Atlantic)", *Ophelia*, vol. 36, No. 3 (1992), pp. 217-226.

[12] W. Pearcy, D. Stein, M. Hixon, E. Pikitch, W. Barss and R. Starr, "Submersible observations of deep-reef fishes of Heceta Bank, Oregon", *Fishery Bulletin*, vol. 87, pp. 955-965; M. Carr, "Habitat selection and recruitment of an assemblage of temperate marine reef fishes", *Journal of Experimental Marine Biology and Ecology*, vol. 146 (1991), pp. 113-137.

[13] M. Love, M. Carr and L. Haldorson, "The ecology of substrate-associated juveniles of the genus *Sebastes*", *Environmental Biology of Fishes*, vol. 30 (1991), pp. 225-243; K. Krieger, "Distribution and abundance of rockfish determined from a submersible and by bottom trawling", *Fishery Bulletin*, vol. 91 (1993), pp. 87-96; M. Yoklavich, H. Greene, G. Caillet, D. Sullivan, R. Lee, M. Love, "Habitat associations of deep-water rockfishes in a submarine canyon: an example of a natural refuge", *Fishery Bulletin*, vol. 98 (2000), pp. 625-641.

[14] L. Garibaldi and L. Limongelli, *Trends in Oceanic Captures and Clustering of Large Marine Ecosystems: Two Studies Based on the FAO Capture Database. FAO Fisheries Technical Paper*, No. 435 (FAO, Rome, 2002); G. Hoff and B. Stevens, "Faunal assemblage structure on the Patton Seamount (Gulf of Alaska, USA)", *Alaska Fishery Research Bulletin*, vol. 11, No. 1, pp. 27-36; J. Koslow, K. Gowlett-Holmes, J. Lowry, G. Poore and A. Williams, "Seamount benthic macrofauna off Southern Tasmania: community structure and impacts of trawling", *Marine Ecology Progress Series*, No. 213 (2001), pp. 111-125; N. Parin, A. Mironov and K. Nesis, "Biology of the Nazca and Sala y Gomez submarine ridges, an outpost of the Indo-West Pacific fauna in the eastern Pacific Ocean: composition and distribution of the fauna, its communities and history", *Advances in Marine Biology*, vol. 32 (1997), pp. 145-242; J. Corliss, J. Dymond, L. Gordon, J. Edmond, R. von Herzen, R. Ballard, K. Green, D. Williams, A. Bainbridge, K. Crane and T. vanAndel, "Submarine thermal springs on the Galapagos Rift", *Science*, vol. 203 (1979), pp. 1073-1083; C. Paull, B. Hecker, C. Commeau, R. Freeman-Lynde, C. Neumann, W. Corso, G. Golubic, J. Hook, E. Sikes and J. Curray, "Biological communities at Florida escarpment resemble hydrothermal vent communities", *Science*, vol. 226 (1984), pp. 965-967; R. Embley, S. Eittreim, C. McHugh, W. Normark, G. Rau, B. Hecker, A. DeBevoise, H. Greene, W. Ryan, C. Harrold and C. Baxter, "Geological setting of chemosynthetic communities in the Monterey fan valley system", *Deep-Sea Research*, vol. 37 (1990), pp. 1651-1667; A. Husebø, L. Nøttestad, J. Fossá, D. Furevik and S. Jørgensen, "Distribution and abundance of fish in deep-sea coral habitats", *Hydrobiologia*, vol. 471 (2002), pp. 91-99.

[15] O. Tendal, "Synoptic checklist and bibliography of the Xenophyophorea (Protista), with a zoogeographical survey of the group", *Galathea Report*, vol. 17 (1996), pp. 79-101.

[16] O. Tendal and A. Gooday, "Xenophyophorea (*Rhizopoda, Protozoa*) in bottom photographs from the bathyal and abyssal NE Atlantic", *Oceanologica Acta*, vol. 4 (1981), pp. 415-422.

[17] A. Klitgaard and O. Tendal, "Distribution and species composition of mass occurrences of large-sized sponges in the north-east Atlantic", *Progress in Oceanography*, vol. 61 (2004), pp. 57-98.

[18] A. Klitgaard, "The fauna associated with outer shelf and upper slope sponges (*Porifera, Demospongia*) at the Faroe Islands, north-eastern Atlantic", *Sarsia*, vol. 80 (1995), pp. 1-22.

[19] A. Klitgaard, "The distribution and habitats in the North Atlantic of two gnathiid species (*Crustacea, Isopoda*) and their reproductive biology in the Denmark Strait and North of Iceland", *Meddelelser om Grøland, Bioscience*, vol. 47 (1997).

[20] G. Menezes, "Demersal fish assemblages in the Atlantic archipelagos of the Azorees, Madeira and Cape Verde", Ph.D. thesis, Department of Oceanography and Fisheries (University of the Azores, Portugal, 2003).

[21] B. Stockley, G. Menezes, M. Pinho and A. Rogers, "Genetic population structure in the black-spot sea bream (*Pagellus bogaraveo Brünnich*, 1768) from the north-east Atlantic", *Marine Biology*, vol. 146 (2005), pp. 793-804.

[22] WWF/IUCN, *The Status of Natural Resources on the High Seas* (Gland, Switzerland, 2001).

[23] T. van Weering, H. de Haas, H. de Stigter, H. Lykke-Andersen and I. Kouvaev, "Structure and development of giant carbonate mounds at south-west and south-east Rockall Trough Margins, north-east Atlantic Ocean", *Marine Geology*, vol. 198 (2003), pp. 67-81.

[24] N. Kenyon, A. Akhmetzhanov, A. Wheeler, T. van Weering, H. de Haas and M. Ivanov, "Giant carbonate mounds in the southern Rockall Trough", *Marine Geology*, vol. 195 (2003), pp. 5-30.

[25] FAO, *State of World Fisheries and Aquaculture (SOFIA)* (Rome, 2004); T. Morato, R. Watson, T.J. Pitcher and D. Pauly, "Fishing down the deep", *Fish and Fisheries*, vol. 7 (2006), pp. 24-34.

[26] A. von Brandt, *Fish Catching Methods of the World*, 3rd edition (Fishing News Books, Ltd., 1984).

[27] A. Freiwald, J. Fossa, A. Grehan, T. Koslow and J. Murray-Roberts, *Cold-water Coral Reefs: Out of Sight-No Longer Out of Mind* (Cambridge, UK, UNEP-WCMC, 2004).

[28] National Research Council, *Effects of Trawling & Dredging on Seafloor Habitat. Committee on Ecosystem Effects of Fishing: Phase 1 — Effects of Bottom Trawling on Seafloor Habitats* (Washington, D.C., National Academy Press, 2002).

[29] J. Fossa, P. Mortensen and D. Furevik, "The deep-water coral *Lophelia pertusa* in Norwegian waters: distribution and fishery impacts", *Hydrobiologia*, vol. 471 (2002), pp. 1-12; J. Roberts, "The occurrence of the coral *Lophelia Pertusa* and other conspicuous epifauna around an oil platform in the North Sea", *Journal of the Society for Underwater Technology*, vol. 25 (2002), pp. 83-91; J. Gordon, "The Rockall Trough, north-east Atlantic: the cradle of deep-sea biological oceanography that is now being subjected to unsustainable fishing activity", *Journal of Northwest Atlantic Fishery Science*, vol. 31 (2003), pp. 57-83; M. Gianni, *High Seas Bottom Trawl Fisheries and their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems*. Report prepared for IUCN, NRDC, WWF International and Conservation International (2004).

[30] S. Garcia, A. Zerbi, C. Aliaume, T. Do Chi and G. Lasserre, *The Ecosystem Approach to Fisheries. Issues, Terminology, Principles, Institutional Foundations, Implementation and Outlook. FAO Fisheries Technical Paper*, No. 443 (Rome, 2003); J. Jackson, M. Kirby, W. Berger, K. Bjorndal, L. Botsford, B. Bourque, R. Bradbury, R. Cooke, J. Erlandson, J. Estes, T. Hughes, S. Kidwell, C. Lange, H. Lenihan, J. Pandolfi, C. Peterson, R. Steneck, M. Tegner and R. Warner, "Historical overfishing and the recent collapse of coastal ecosystems", *Science*, vol. 293 (2001), pp. 629-638; M. Sinclair, and G. Valdimarsson, editors, *Responsible Fisheries in the Marine Ecosystem* (CAB International, Cambridge University Press, UK, 2003).

[31] Garcia et al., op. cit., note 30; National Research Council, *Dynamic Changes in Marine Ecosystems: Fishing, Food Webs and Future Options. Committee on Ecosystem Effects of Fishing: Phase II — Assessments of the Extent of Change and the Implications for Policy* (Washington, D.C., National Academy Press, 2006).

[32] Sinclair and Valdimarsson, op. cit., note 30.

[33] National Research Council, op. cit., note 31.

[34] S. Løkkeborg, *Impacts of Trawling and Scallop Dredging on Benthic Habitats and Communities. FAO Fisheries Technical Paper*, No. 472 (FAO, Rome, 2005); S. Jennings and M. Kaiser, "The effects of fishing on marine ecosystems", in *Advances in Marine Biology*, vol. 34, J. Blaxter, A. J. Southward and P. Tyler, editors (New York, Academic Press, 1988); M. Barnette, "Gulf of Mexico fishing gear and their potential impacts on essential fish habitat". *NOAA Technical Memorandum*; J. Collie, S. Hall, M. Kaiser and I. Poiner, "A quantitative analysis of fishing impacts on shelf-sea benthos", *Journal of Animal Ecology*, vol. 69 (2000), pp. 785-798; S. Thrush, J. Hewitt, V. Cummings, P. Dayton, M. Cryer, S. Turner, G. Funnell, R. Budd, C. Millburn and M. Wilkinson, "Disturbance of the marine habitat by commercial fishing: impacts at the scale of the fisher", *Ecological Applications*, vol. 8, No. 3 (1988), pp. 866-879; I. Tuck, S. Hall, M. Robertson, E. Armstrong and D. Basford, "The effects of physical trawling disturbance in a previously unfished sheltered Scottish sea loch", *Marine Ecology Progress Series*, vol. 162 (1998), pp. 227-242; L. Watling and E. Norse, "Disturbance of the seabed by mobile fishing gear: a comparison to forest clearcutting", *Conservation Biology*, vol. 12, No. 6 (1998), pp. 1180-1197; P. Auster and R. Langton, "The effects of fishing on fish habitat", in *Essential Fish Habitat and Rehabilitation*, L. Benaka, editor (Bethesda, Maryland, American Fisheries Society, 1999), pp. 150-187.

[35] *FAO Fisheries Technical Paper*, No. 472, op. cit., note 34.

[36] J. Koslow et al., op. cit., note 14; O. Anderson and M. Clark, "Analysis of bycatch in the fishery for orange roughy, *Hoplostethus atlanticus*, on the South Tasman Rise", *Marine and Freshwater Research*, vol. 54, No. 5 (2003), pp. 643-652.

[37] J. Heifetz, "Coral in Alaska: distribution, abundance, and species associations", *Hydrobiologia* vol. 47, No. 1 (2002), pp. 19-28.

[38] H. Breeze, D. Davis, M. Butler and V. Kostylev, "Distribution and status of deep-sea corals off Nova Scotia", *Marine Issues Committee special publication*, No. 1 (Ecology Action Centre, Halifax, Nova Scotia, 1997; Fisheries and Oceans Canada, *Deep-Sea Coral Research and Conservation in Offshore Nova Scotia: Backgrounder B-MAR-02-(5E)* (Halifax, July 2002). Available at http://www.mar.dfo-mpo.gc.ca/communications/mar...es/back02e/B-MAR-02-(5E).html.

[39] J. Hall-Spencer, V. Allain and J. Fossa, "Trawling damage to north-east Atlantic ancient coral reefs", *Proceedings of the Royal Society. B.*, vol. 269 (2002), pp. 507-511.

[40] P. Masson, B. Bett, D. Billett, C. Jacobs, A. Wheeler and R. Wynn, "The origin of deep-water, coral-topped mounds in the northern Rockall Trough, north-east Atlantic", *Marine Geology*, vol. 194 (2003), pp. 159-180; J. Gordon, O. Bergstad, I. Figueredo and G. Menezes, "Deep-water fisheries of the north-east Atlantic: I. Description and trends", *Journal of Northwest Atlantic Fishery Science*, vol. 31 (2003), pp. 137-151.

[41] B. Bett, "UK Atlantic margin environmental survey: introduction and overview of bathyal benthic ecology", *Continental Shelf Research*, vol. 21 (2001), pp. 917-956; Fossá et al., op. cit., note 29; OSPAR, "Information on threats to seamounts" (2004).

[42] Auster and Langton, op. cit., note 34.

[43] Gordon et al., op. cit., note 40.

[44] J. Roberts, D. Long, J. Wilson, P. Mortensen and J. Gage, "The cold-water coral *Lophelia pertusa* (Scleractinia) and enigmatic seabed mounds along the north-east Atlantic margin: are they related?", *Marine Pollution Bulletin*, vol. 46 (2003), pp. 7-20.

[43] L. Borets, "Some results of studies on the biology of the boarfish (*Pentaceros richardsoni* Smith), *Investigations of the Biology of Fishes and Fishery and Fishery Oceanography* (TINRO, Vladivostok, 1975), pp. 82-90.

[46] R. Grigg, "Precious coral fisheries of Hawaii and the US Pacific Islands", *Marine Fisheries Review*, vol. 55 (1993), pp. 50-60.

[47] O. Bergstad, and O. Godo, "The pilot project 'Patterns and processes of the ecosystems of the northern mid-Atlantic': aims, strategies and status", *Oceanologica Acta*, vol. 25 (2003), pp. 219-225.

[48] A. Grehan, V. Unnithan, A. Wheeler, X. Monteys, T. Beck, M. Wilson, J. Guinan, A. Foubert, M. Klages and J. Thiede, "Evidence of major fisheries impact on cold-water corals in the deep waters off the Porcupine Bank, West Coast of Ireland: are interim management measures required?" (Copenhagen, ICES, 2004).

[49] ICES, "Report of the working group on biology and assessment of deep-sea fisheries resources" (Copenhagen, 2006).

[50] National Research Council, op. cit., note 30.

[51] Garcia et al., op. cit., note 30; National Research Council, op. cit., note 31; D. Pauly, C. Christensen, J. Dalsgaard, R. Froese and F. Torres Jr., "Fishing down marine food webs", *Science*, vol. 279 (1998), pp. 860-863; S. Garcia and R. Grainger, "Gloom and doom? The future of marine capture fisheries", *Philosophical Transactions of the Royal Society*, B., vol. 360 (2005), pp. 21-46.

[52] Koslow et al., op. cit., note 14; Garibaldi and Limongelli, op. cit., note 14.

[53] J.-J. Maguire, M. Sissenwine, J. Csirke, R. Grainger, and S. Garcia, *The State of World Highly Migratory, Straddling and Other High Seas Fishery Resources and Associated Species. FAO Fisheries Technical Paper*, No. 495 (Rome, FAO, 2006).

[54] Devine et al., "Fisheries: Deep-sea fishes qualify as endangered", *Nature*, vol. 439, No. 29 (January 2006).

[55] ICES, *Deep Water Fisheries Resources South of 63 degrees North: Report of the ICES Advisory Committee on Fisheries Management, ICES Advice, vol. 10* (Copenhagen, 2005).

[56] ICES, *Report on the Study Group on the Mapping of Cold Water Corals* (2002).

[57] J. Lutjeharms and A. Heydorn, "The rock-lobster (*Jasus stristani*) on Vema Seamount: drifting buoys suggest a possible recruiting mechanism", *Deep-Sea Research*, vol. 28A, No. 6 (1981), pp. 631-636.

[58] T. Sasaki, "Development and present status of Japanese trawl fisheries in the vicinity of seamounts", in *The Environment and Researches of Seamounts in the North Pacific. Proceedings of the Workshop on the Environment and Resources of Seamounts in the North Pacific*, R. Uchida, S. Hayashi and G. Boehlert, editors (US Department of Commerce, National Oceanic and Atmospheric Administration, Technical Report, National Marine Fisheries Service, vol. 43) pp. 21-38.

[59] J. Koslow, G. Boehlert, J. Gordon, R. Haedrich, P. Lorance and N. Parin, Continental slope and deep-sea fisheries: implications for a fragile ecosystem", *ICES Journal of Marine Science*, vol. 57 (2000), pp. 548-557.

[60] R. Grigg, "Resource management of precious corals: a review and application to shallow water reef building corals", *Marine Ecology*, vol. 5, No. 1 (1984), pp. 57-74.

[61] V. Vinnichenko, *Alfonsino* (Beryx splendens) *Biology and Fishery on the Seamounts in the Open North Atlantic* (ICES, 1998).

[62] Commission of the European Communities, *Deep-Sea Fisheries. Commission Staff Working Paper. Report of the Subgroup Fishery and Environment of the Scientific, Technical and Economic Committee for Fisheries* (Brussels, 2002), pp. 46-51.

[63] ICES, *Report of the International Bottom Trawl Survey Working Group* (Copenhagen, 2006).

[64] ICES, *Report of the Working Group on Biology and Assessment of Deep-Sea Fisheries Resources* (Copenhagen, 2001).

[65] National Research Council, op. cit., note 31.

[66] J. Collie, G. Escanero and P. Valentine, "Effects of bottom trawling on the benthic megafauna of George's Bank", *Marine Ecology Progress Series*, vol. 155 (1997), pp. 159-172.

[67] Koslow et al., op. cit., note 14.

[68] J. Engel, and R. Kvitek, "Effects of otter trawling on a benthic community in Monterey Bay National Marine Sanctuary", *Conservation Biology*, vol. 12 (1998), pp. 1204-1214.

[69] Koslow et al., op. cit., note 14; Roberts, op. cit., note 29.

[70] Fisheries and Oceans Canada, op. cit., note 38.

[71] Løkkeborg, op. cit., note 34.

[72] M. Clark, S. O'Shea, D. Tracey and B. Glasby, *New Zealand Region Seamounts. Aspects of their Biology, Ecology and Fisheries: Report prepared for the Department of Conservation* (Wellington, August 1999).

[73] Anderson and Clark, op. cit., note 36.

[74] K. Kelleher, *Discards in the world's fisheries: an update. FAO Fisheries Technical Paper*, No. 470 (Rome, 2005).

[75] Third Informal Consultations of the States parties to the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 8-9 July 2004 (ICSP3/UNFSA/REP/INF.1, paras. 11-13).

[76] ICES Divisions VIab, VIIbcjk and Subarea XII.

[77] ICSP3/UNFSA/REP/INF.1, op. cit., note 75, paras. 9-21.

[78] See http://www.neafc.org/about/docs/convention.pdf.

[79] See http://www.fao.org/figis/servlet/static?dom=root&xml=index.xml.

[80] Garcia and Grainger, op. cit., note 51.

[81] NAFO, stock assessments; see http://www.nafo.ca/science/frames/science.html (2006).

[82] 24th Annual Meeting of the North-East Atlantic Fisheries Commission, 14-18 November 2005. NEAFC Commission report AM2005.

[83] Information from Australia's submission.

[84] Annual report of the Inter-American Tropical Tuna Commission 2004 (La Jolla, California).

[85] ICCAT resolution 05-08 on use of circle hooks.

[86] ICCAT resolution 02-14 on incidental mortality of seabirds.

[87] International Pacific Halibut Commission 2006 Annual Meeting, 23 January 2006.

[88] NAFO Conservation and Enforcement Measures (FC doc. 06/1 Ser. No. N5206).

[89] NASCO Plan of Action for the Application of the Precautionary Approach to the Protection and Restoration of Atlantic Salmon Habitat (CNL(01)51, 2002).

[90] IPHC, "Halibut Commission completes 2006 annual meeting", news release.

[91] NASCO, "Mystery deaths of wild Atlantic salmon tackled by NASCO", press release (CNL(06)47, 2005), twenty-third annual meeting, Saariselkä, Finland, 5-9 June 2006; Report of the twenty-second annual meeting, Vichy, France (CNL(05)50, 2005).

[92] SEAFO, Report of SEAFO Scientific Committee 2005.

[93] Text of the CCAMLR System Inspection, point 9.

[94] Fourth Informal Consultations of the States parties to the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 31 May-3 June 2005 (ICSP4/UNFSA/REP/INF.1).

[95] NAFO, Report of the twenty-seventh annual meeting, September 2005, Annual compliance review 2004 (NAFO/FC doc.05/6).